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EXPERIENCES WITH FISTULIZATION OF THE LABYRINTH IN CHRONIC PROGRESSIVE DEAFNESS

REPORT OF CASES

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PHILADELPHIA

The treatment of chronic progressive deafness in the past by any of the conservative measures has been so unsatisfactory that one is apt to grasp with enthusiasm any new procedure that gives a chance for improvement. Fistulization of the labyrinth has been known for many years to give immediate improvement of hearing in typical cases of otosclerosis or in other cases of chronic progressive deafness in which the bone conduction has remained good. The problem of the earlier experimenters in this field has not been so much one of obtaining improvement in hearing by operative means as it has been to maintain the improvement obtained. The surgical procedures used by Holmgren [1] and Sourdille [2] in the past few years have been successful in obtaining the desired improvement in many cases, but in apparently the great majority of such cases this improvement of hearing has been of short duration, the early regeneration of bone in the labyrinthine fistula resulting in the loss of all improvement obtained by the operation.

The real problem, then, in the attempt to improve the hearing in these cases by surgical means has been the development of a method whereby regeneration of bone in the fistulized labyrinth can be prevented. This problem seems to have been successfully solved by Lempert [3] by the use of an electrically driven dental polishing burr to excavate a

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From the Department of Otolaryngology of the University of Pennsylvania.

Read before the Section on Otolaryngology of the College of Physicians of Philadelphia, Feb. 15, 1939.

1. Holmgren, G.: The Surgery of Otosclerosis, Ann. Otol., Rhin. & Laryng. **46**:3 (March) 1937.

2. Sourdille, N.: New Technique in the Surgical Treatment of Severe and Progressive Deafness from Otosclerosis, Bull. New York Acad. Med. **3**:367 (Dec.) 1937.

3. Lempert, J. C.: Improvement of Hearing in Cases of Otosclerosis: A New One-Stage Surgical Technic, Arch. Otolaryng. **28**:42 (July) 1938.

troughlike fenestra in the bony capsule of the external semicircular canal. The slow shaving down by means of the burr apparently in some way prevents the regeneration of bone and allows the fistula to remain open.

While the use of the burr is probably the main factor in preventing closure of the fistulized labyrinth, an important factor also is the method of closely applying the tympanomeatal cutaneous membrane over the fistula. It seems possible that this close apposition causes contact of the tympanomeatal membrane with the membranous labyrinth and in healing these two membranes become firmly attached by fibrous adhesions. If such adhesions occur it should be sufficient to prevent closure of the area of contact by regeneration of the bony walls of the fistula.

Since the hearing in cases of otosclerosis can be improved by fistulization of the labyrinth and the fistula can be made to remain open by adherence to an exacting technic, one can expect permanent improvement of hearing in cases which are suitable for the operation.

SELECTION OF PATIENTS

Just what type of patient is suitable for the operation is still somewhat uncertain, but, in general, the deafness must be of the conductive type, with good bone conduction; the tympanic membrane must be normal, and the labyrinth must react normally to caloric testing. In estimating the bone conduction an audiogram from the bone conduction receiver of an audiometer is desirable, but it seems doubtful if tests with bone conduction receivers are sufficiently accurate to make such audiograms of practical value. Tuning fork tests give an adequate estimation of the bone conduction, and when it can be shown that the ear responds negatively to the Rinne test and when the Weber test shows lateralization of the tone to the deafer ear, it can be decided that the ear is suitable for operation, at least as far as the bone conduction is concerned.

While it seems desirable in the selection of cases for operation that the tympanic membrane should be normal, it is probably not strictly necessary. If the drum shows some thickening, retraction and scarring as a result of attacks of otitis media, it is probably still suitable for operation, although the results are likely not to be as good as when the drum is normal.

A normally functioning labyrinth appears to be a definite prerequisite for the operation. In one of my cases, although the bone conduction was fair, the labyrinth was apparently dead or much weakened, for on exposing the membranous labyrinth of the external semicircular canal there was no dizziness and no improvement in the hearing. Even when the membranous labyrinth was opened no vertigo or nystagmus followed.

When the case for operation is properly selected, to obtain the best result it is necessary that the surgical technic be closely followed in every detail. While the technic described by Lempert [3] is difficult, it is not at all impossible and requires only a knowledge of the anatomy of the parts involved, time and a patience that many will find difficult to acquire. Having had the privilege of closely observing Dr. Lempert's technic in operation in such cases and the advantage of studying his records and interviewing many of the patients on whom he has operated, I have been greatly impressed by the practical improvement in hearing which this operation has given them.

My own experience with the operative treatment of such deaf patients has been limited to 8 cases, in 7 of which the Lempert technic was closely followed; in the remaining case, fistulization of the external semicircular canal was performed after the patient had had a successful radical mastoidectomy. In 2 of the 8 patients operated on I have reopened the fistula in the labyrinth because of its closure by bony regeneration after the first operation.

In the following report of these cases I have emphasized some of the technical errors that may be committed without causing irreparable damage to the parts involved and often without impairing the results of the operation. The amount of loss of hearing for speech has been expressed in percentages with the realization that this is an inaccurate method of determining the degree of practical hearing, in an attempt to compare the hearing before and after operation. The percentages were obtained by multiplying the average reading at the frequencies 512, 1024 and 2048 by 0.8. Bone conduction audiograms obtained by the bone conduction receiver of the audiometer were made in each case, but the instrument used was not considered sufficiently accurate for them to have any practical value. In the estimation of the bone conduction in these cases more reliance was placed on the use of tuning forks. In obtaining records of hearing a masker was used on the better ear in each case.

PREOPERATIVE PREPARATION

In all these cases the following preoperative preparation has been carried out:

1. For two days before operation, instillation (by the patient) in the ear to be operated on of several drops of 70 per cent alcohol four times a day in an attempt to sterilize the operative field.

2. Shaving of the head for 2 inches (5 cm.) around the margin of the auricle the evening before operation.

3. Thorough cleansing of the auricle, adjacent areas and external auditory canal with soap and water followed by alcohol and covering of these areas with a sterile dressing.

4. Administration of 4½ grains (0.3 Gm.) of pentobarbital sodium one hour and a half before operation and hypodermic injection of morphine sulfate ⅙ grain (0.0108 Gm.) and scopolamine hydrobromide 1/150 grain (0.0004 Gm.) forty-five minutes before operation.

5. Immediately before operation, further application of 70 per cent alcohol to the area to be operated on.

With the preoperative sedation described the patient comes to the operating room sound asleep, although he can be roused fairly easily. If he does not appear sufficiently narcotized he is given at the time of operation another ⅙ or ¼ grain (0.0108 or 0.0162 Gm.) of morphine sulfate. If necessary, one or two injections of this drug are given during the course of the operation. The local anesthetic consists of a 1 per cent solution of procaine hydrochloride with sufficient epinephrine to make a

TABLE 1.—*Audiometric Recordings Before and After Operation on the Right Ear on June 29, 1938 (Case 1)*

Audiometer Frequencies	Right Ear				Left Ear			
	6/18/38	7/9/38	12/1/38	2/8/39	6/18/38	7/9/38	12/1/38	2/8/39
128	58	29	39	27	42	50	45	48
256	50	37	47	38	43	44	40	40
512	67	47	37	34	55	49	41	39
1024	53	42	37	36	38	42	49	46
1448	57	58	35	37	49	58	60	63
2048	85	73	59	59	67	73	77	81
2900	88	83	73	69	81	83	90	88
4096	88	83	76	84	82	82	84	82
5792	100	100	100	100	100	100	63	70
8192	100	100	100	100	100	100	60	64
Loss of hearing for speech, %	54.7	42.7	35.5	34.4	42.7	43.7	44.8	43.3

1 to 20,000 solution. Only a small amount of this local anesthetic is needed, along the anterior margin of the concha, in the posterior and superior walls of the canal and in the area above the tragus.

REPORT OF CASES

CASE 1.—E. H., a man aged 35, an office worker, had had gradually increasing deafness of both ears, especially of the right, for the last seven years, with occasional mild dizziness. He had never had abscesses of the ears. There were no symptoms referable to the nose or throat and no familial deafness. Both drums were normal except for slight thickness. Preoperative hearing tests by audiometer on June 18, 1938, showed (by air conduction) a 54.7 per cent loss in the right ear and 42.7 per cent loss in the left ear. Bone conduction was normal in both ears, with lateralization of the tone to the right.

Operation was performed on June 29, 1938, on the right ear. On July 9, three weeks after operation, hearing tests showed a 42.7 per cent loss in the right ear and a 43.7 per cent loss in the left. On October 18, three and a half months after operation, hearing tests showed a 42.7 per cent loss in each ear. On December 1, five months after operation, the right ear showed a 35.5 per cent loss of hearing, and on Feb. 8, 1939, a 34.4 per cent loss.

Comment.—It is now eight months since the operation, and the fistula test produces a moderately active reaction. There has been a 20 per cent improvement in hearing, and although this still leaves the patient with a 34 per cent loss on the side of the operation, the improvement in his hearing has been pleasing and beneficial to him, and many of his friends have complimented him on it. He is now planning to take time from his work to have an operation on the left ear. It is noteworthy that this improvement has resulted in spite of the accidental loss of the skin of the posterior wall of the canal during the operation. This was torn loose from the drum by the drill, and to replace it a plastic skin flap from the lower and anterior wall of the canal was dissected free, stretched across the external auditory canal and placed over the edge of

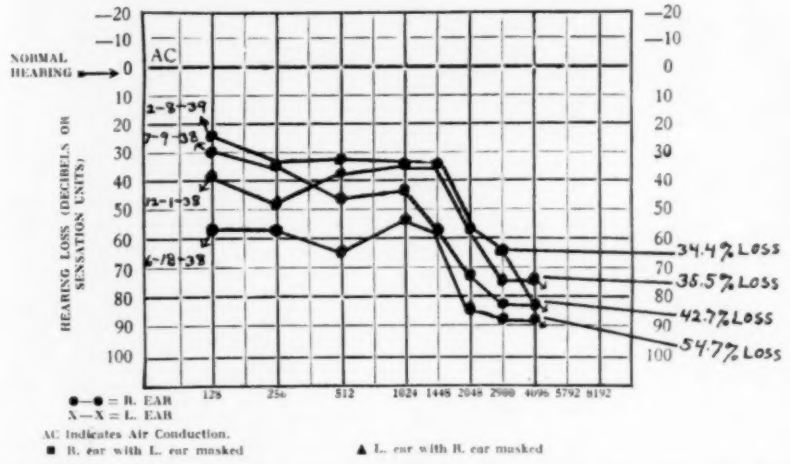

Chart 1 (case 1).—Audiograms showing the hearing in the right ear before and after operation on June 29, 1938.

the drum, the incus and the fistula of the external semicircular canal. In healing this has left a firm band stretched across the auditory canal, with the drum visible below it and the area of the aditus and antrum above it. The external auditory meatus has been reduced to about one-third its normal size by the fibrosis set up. The tinnitus also has been much reduced in the ear operated on.

Case 2.—S. H., a man aged 43, had noticed gradually increasing noises in both ears with failing hearing for ten years or more. He felt that the noises were becoming unbearable. He was given a course of treatments consisting of inflation of his ears for about two months, without any improvement in the deafness or tinnitus. Tuning fork tests showed considerable loss of hearing in both ears, with some diminishing of bone conduction and no lateralization of tone. Both ear drums were normal. An audiogram on July 12, 1938, showed a 40 per cent loss of hearing in the right ear and a 38.1 per cent loss in the left.

Operation was performed on the right ear on July 13. Tuning fork and voice tests after operation showed considerable reduction in the hearing, and it has not improved since.

Comment.—The operation on this patient was a complete failure. It was realized before operation that the patient was not an entirely suitable one for the operation because of the poor bone conduction, but it was thought that there was a chance of improving the tinnitus, which was extremely distressing. During the operation, in the process of fistulizing the external semicircular canal the membranous labyrinth was

TABLE 2.—*Audiometric Recordings Before and After Operations on the Right Ear on July 20 and Dec. 8, 1938 (Case 3)*

Audiometer Frequencies	Right Ear							
	2/17/38	7/1/38	11/8/38	12/5/38	12/17/38	12/24/38	1/10/39	1/17/39
128	37	34	54	53	22	16	15	22
256	45	41	62	58	35	33	36	43
512	48	51	66	67	52	49	60	64
1024	49	53	77	65	42	38	52	52
1448	52	53	70	63	47	45	47	52
2048	56	63	69	64	49	48	54	56
2900	56	55	79	76	63	48	52	51
4096	63	78	100	100	100	77	75	81
5792	100	100	100	100	100	100	100	100
8192	100	100	100	100	100	100	100	100
Loss of hearing for speech, %	40.8	44.8	56.3	52.3	37.9	35.7	44.3	45.6
Audiometer Frequencies	Left Ear							
	2/17/38	7/1/38	11/8/38	12/5/38	12/17/38	12/24/38	1/10/39	1/17/39
128	33	35	55	47	53	49	57	53
256	38	45	47	46	43	41	45	40
512	52	57	51	56	59	62	68	63
1024	36	43	47	43	41	38	38	52
1448	42	45	47	47	46	53	57	52
2048	42	49	51	49	49	50	47	55
2900	52	55	52	53	54	59	63	51
4096	69	81	56	62	69	70	72	81
5792	100	100	100	100	100	100	100	100
8192	100	100	100	100	100	100	100	100
Loss of hearing for speech, %	34.7	39.7	39.7	39.5	39.7	40.3	40.8	39.2

perforated, and in separating the malleus from the incus the latter was dislocated and had to be removed. The vertigo following the operation was severe for five or six days and gradually less for the next three weeks. It appears that the loss of the incus, breaking the conducting chain, is at least a factor in the reduction of hearing that has resulted. The perforation of the membranous external semicircular canal might reasonably be supposed to result in the loss of hearing, but this patient's bone conduction remains as good as and probably better than before the operation, and the tone is lateralized to the ear operated on. There is no fistula reaction, and the tinnitus has not been improved.

CASE 3.—C. P., a girl aged 19, complained of gradually increasing deafness and mild tinnitus in both ears, particularly in the right, for four and a half years.

She had never had abscesses of the ear or dizziness. She had had much nasal and tubal treatment without improvement. Neither her father nor her mother was deaf. Both tympanic membranes showed some thickening and areas which were probably scars of suppurative otitis media. The hearing, measured by tuning fork and voice tests, was much impaired in both ears, but more in the right, with normal bone conduction in both and lateralization of tone to the right. On inflation of the eustachian tubes air entered both middle ears easily and well. Adhesions

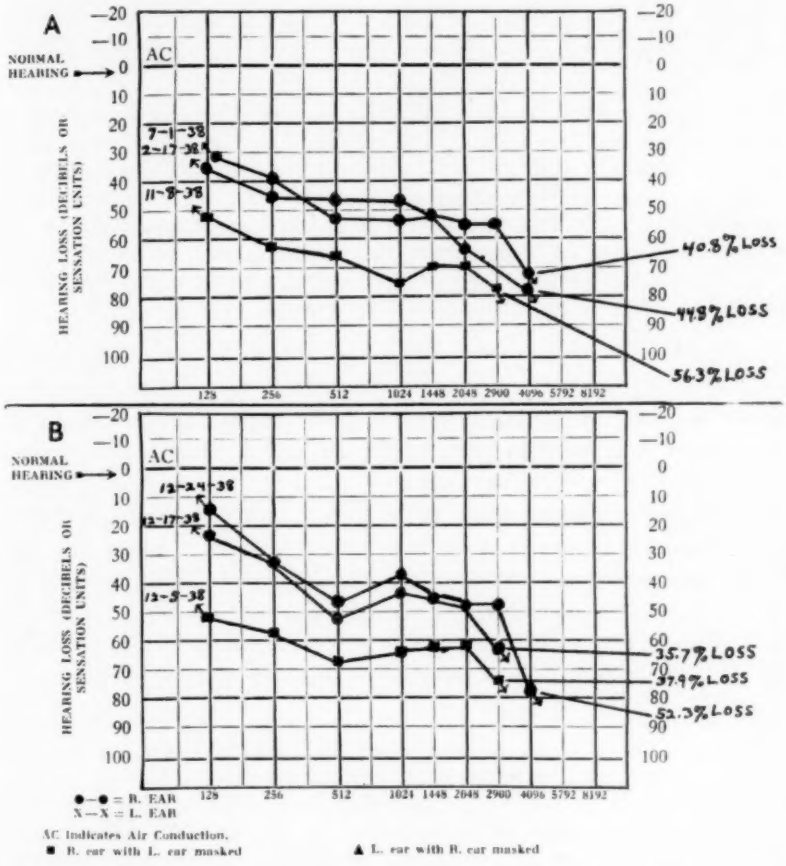

Chart 2 (case 3).—Audiograms showing the hearing in the right ear before and after (*A*) operation on July 20, 1938, and (*B*) revision on Dec. 8, 1938.

were present between the posterior wall of the eustachian tubes and the nasopharynx. An audiogram on Feb. 17, 1938, showed a 40.8 per cent loss of hearing in the right ear and a 37.7 per cent loss in the left. During the next four months the patient received frequent inflation treatments, and adhesions were broken up around the eustachian orifices. On July 1 an audiogram showed a 44.8 per cent loss of hearing in the right ear and a 39.7 per cent loss in the left.

Operation was partially performed on the right ear on July 20. Exenteration of the mastoid cells and removal of the bony walls on the posterior and superior

sides of the drum were so difficult and required so much time that the operation was not completed. Two days later the operation was finished by fistulizing the external semicircular canal and fixing the skin flap over the fistula. The hearing was much improved while the patient was on the table, and there was moderate dizziness. The improvement began to fade within a week after operation; at the end of three weeks, it had diminshed below what it was before operation, and the fistula reaction had disappeared. On November 8, an audiogram showed a 56.3 per cent loss of hearing in the right ear and a 39.7 per cent loss in the left. This was 11.5 per cent greater than the preoperative loss. One month later, on December 5, the right ear showed a loss of 52.3 per cent. On December 8, operation was again performed on the right ear, the skin overlying the mastoid cavity and the external semicircular canal being elevated and the canal reopened by means of the burr. There was considerable vertigo, and the hearing was markedly improved while the patient was on the table. The skin flap was then replaced over the fistula. On December 17 (nine days after operation) an audiogram showed a 37.9 per cent loss of hearing in the right ear (an improvement of 14.4 per cent over the preoperative hearing). One week later an audiogram showed a 35.7 per cent loss (an improvement of 16.6 per cent over the preoperative hearing). On Jan. 10, 1939 (three weeks later), the right ear showed a 44.3 per cent loss, and one week later, January 17, the loss was 45.6 per cent.

Comment.—This case well illustrates the difference there may be between the percentage of improvement in hearing registered by the audiometer and the practical improvement registered by the patient. She can now hear conversation, which was not audible before, and can enjoy moving pictures. She is happy about the improvement, and her outlook on life has changed for the better. The question is whether this improvement in hearing will be maintained. In the past month some of the improvement has been lost, the percentage of loss going from 35.7 to 45.6. Is bony regeneration of the labyrinth again taking place? She still has a fistula reaction, but this is not so active as it was two weeks ago. I doubt that her improvement in hearing will be maintained.

CASE 4.—E. W., aged 21, a salesgirl, had noticed rapidly increasing deafness for about five months, with tinnitus, which had recently become severe in the right ear. There was no dizziness or pain in the ears. She had never had abscesses of the ears. A sister had been deaf since childbirth, but there was no other history of deafness in the family. She was not especially subject to colds in the nose, and there was no trouble with the throat. She had received no treatment of the ears but considerable of the nose. Both ear drums were normal, except possibly for slight thickness. Both eustachian tubes inflated easily and well without improvement in hearing.

Tuning fork and voice tests showed considerable impairment of hearing in both ears, with normal bone conduction in both and lateralization of tone to the right. An audiogram on Aug. 25, 1938, showed a loss of hearing of 35.5 per cent in the right ear and 27.7 per cent in the left ear.

Operation was performed on the right ear on August 29. Opening the external semicircular canal caused mild dizziness and considerable improvement in hearing. When the gauze packing was removed from the wound, at the end of a week, the hearing was still improved, and the fistula reaction was active. During the next two weeks, however, the hearing gradually failed, until one month after

operation it was worse than before and the fistula reaction was absent. On October 6 (five weeks after operation) an audiogram showed a 36.3 per cent loss of hearing in the right ear and a 25.3 per cent loss in the left. Seven weeks later, on November 26, the right ear showed a 41.3 per cent loss and the left ear a 28.5 per cent loss. On December 29 the loss was 36.8 per cent in the right ear, a decrease of 9 per cent from the hearing before the operation, and 27.5 per cent in the left ear.

On Jan. 5, 1939, reoperation was done, the skin overlying the mastoid cavity and the external semicircular canal being elevated and the semicircular canal reopened with the burr. The membranous labyrinth was exposed over a wide

TABLE 3.—*Audiometric Recordings Before and After Operations on the Right Ear on Aug. 29, 1938, and Jan. 5, 1939 (Case 4)*

Audiometer Frequencies	Right Ear							
	8/25/38	10/6/38	11/26/38	12/29/38	1/14/39	1/17/39	1/25/39	2/7/39
128	37	56	58	55	67	62	57	42
256	46	51	58	56	70	67	61	52
512	49	52	57	52	75	65	57	44
1024	46	48	53	48	49	47	38	37
1448	48	37	40	37	35	28	33	32
2048	28	36	45	38	32	33	33	32
2900	42	40	42	48	35	32	22	22
4096	42	70	67	73	62	63	64	53
5792	66 ?	100	100	100	100	100	100	100
8192	100	100	100	100	100	100	100	100
Loss of hearing for speech, %	35.5	36.3	41.3	36.8	40.8	37.9	33.3	30.4
	Left Ear							
Audiometer Frequencies	8/25/38	10/6/38	11/26/38	12/29/38	1/14/39	1/17/39	1/25/39	2/7/39
128	45	48	45	39	42	41	45	50
256	42	45	45	40	39	41	43	43
512	42	37	43	43	48	45	48	51
1024	40	40	42	37	38	37	34	33
1448	33	27	34	33	30	32	38	37
2048	22	18	22	23	26	25	23	25
2900	39	27	30	34	38	41	43	45
4096	69	57	62	58	53	55	59	63
5792	100	100	100	100	100	100	100	100
8192	100	100	100	100	100	100	100	100
Loss of hearing for speech, %	27.7	25.3	28.5	27.5	30.1	28.5	28	28.5

area, without injury to it. The skin flap was then replaced and fixed in position with gauze packing. There was mild dizziness and the hearing was again much improved while the patient was on the operating table. (Slight whispering was distinctly heard.) On January 14 (nine days after operation) an audiogram showed some loss of hearing for the three lowest tones but an improvement for the middle tones (the total loss being 40.8 per cent). Three days later there was an improvement to a 37.9 per cent loss of hearing and one week later to a 33.3 per cent loss; on February 7 the loss was 30.4 per cent.

Comment.—The result in this case is still somewhat in doubt. At the original operation the hearing was so markedly improved when the labyrinth was opened that a good result was anticipated. As the labyrinthine fistula gradually closed, the hearing became steadily worse, until it was 9 per cent below its level before operation. At the second operation, when the external semicircular canal was again fistu-

lized, there was again marked improvement in hearing measured by voice tests. However, when the gauze packing was removed, on the eighth day, an audiogram showed the hearing unimproved. Since then audiograms taken at intervals of three to seven days have shown a steady improvement of hearing, and the last one (taken on Feb. 7, 1939) showed a 30.4 per cent loss of hearing, an improvement of 11 per cent

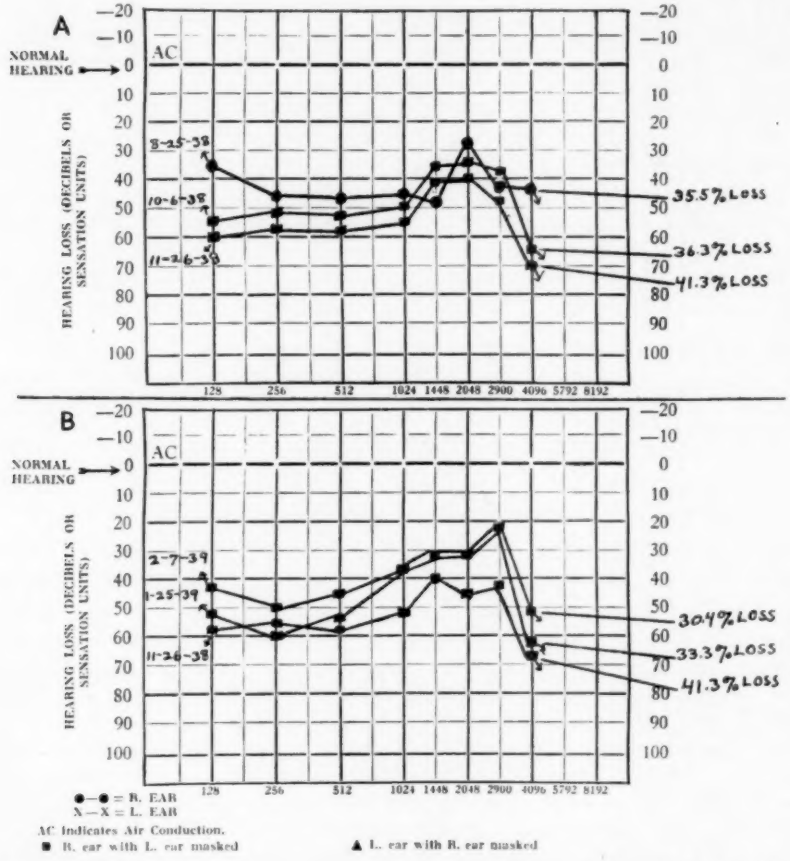

Chart 3 (case 4).—Audiograms showing the hearing in the right ear before and after (*A*) operation on Aug. 29, 1938, and (*B*) revision on Jan. 5, 1939.

since before the second operation. The fistula reaction is active, and I believe there will be further improvement as the inflammatory reaction of the skin surface subsides and the thick exudative fluid secretion overlying the operative area becomes less.

CASE 5.—N. G., a woman aged 44, had had a radical mastoidectomy on the right at 15 years of age because of a constant running ear for the previous ten years. The ear healed promptly and since the operation had remained dry but

had shown considerable impairment of hearing, with marked tinnitus. For the past fifteen years there had been an intermittent discharge of pus from the left ear, which for the past two years had been practically constant. The patient had noticed gradually increasing deafness also in the left ear. Tuning fork tests showed a moderate impairment of hearing in both ears, slightly more marked in the right, with normal bone conduction in both and lateralization of tone to the right ear. The right ear showed a rather large excavated mastoid process, with a thin skin completely covering this area and also the region of the antrum, the aditus and the inner wall of the middle ear. The left drum showed a large central perforation, partly filled in by granulation tissue and overlaid by thick, foul pus. An audiogram on Sept. 26, 1938, showed a 25.9 per cent loss of hearing in the right ear and a 28 per cent loss in the left ear.

On September 30 operation was performed on the right ear. Through an endaural incision the skin overlying the cavity of the mastoid, the antrum and the aditus was elevated and displaced anteriorly, with exposure of the external semicircular canal. This was worn down by the burr and the membranous

TABLE 4.—*Audiometric Recordings Before and After Operation on the Right Ear on Sept. 30, 1938 (Case 5)*

Audiometer Frequencies	Right Ear				Left Ear			
	9/26/38	10/14/38	11/23/38	1/17/39	9/26/38	10/14/38	11/23/38	1/17/39
128	46	66	58	45	41	34	22	25
256	46	65	55	46	42	39	26	25
512	40	72	53	46	47	47	32	41
1024	29	51	30	34	36	22	16	14
1448	41	62	37	35	34	20	17	14
2048	28	55	25	26	23	20	13	16
2900	40	67	24	23	35	33	23	10
4096	47	63	32	43	52	54	32	54
5792	51	56	36	48	38	41	44	37
8192	40	46	36	47	33	35	26	27
Loss of hearing for speech, %	25.9	47.7	30.1	28.3	28	23.7	16.5	16

labyrinth exposed. This procedure resulted in considerable dizziness, with nausea, and much improvement in hearing. The skin flap was then replaced and held firmly in position by gauze packing. The operation was followed by intense dizziness and frequent vomiting and nystagmus until the gauze packing was loosened somewhat and part of it removed. Severe dizziness, however, persisted for several weeks, even after all packing had been removed, but became gradually less during the second month after operation. During this period of intense dizziness the hearing was worse than before operation, but as the dizziness subsided the hearing improved. An audiogram on October 14 showed a 47.7 per cent loss of hearing in the right ear, compared with a 25.9 per cent loss before the operation. On November 23 an audiogram showed a 30.1 per cent loss in the right ear and a 16.5 per cent loss in the left ear. On Jan. 17, 1939, the right ear showed a 28.3 per cent loss, 2.4 per cent greater than the loss before operation, and the left ear showed a 16 per cent loss.

Comment.—The result in this case shows that it takes more than fistulization of the labyrinth to improve the hearing. Here the external semicircular canal was widely opened and a thin skin placed firmly over it. The fistula has remained open, but the hearing has not been

improved. It emphasizes the necessity of a mechanism in the middle ear, that is, a normal or nearly normal drum and tympanic cavity to obtain the greatest amount of improvement in hearing.

During the three and one-half months since the operation the hearing of the ear not operated on has improved 12 per cent, because persistent treatment of that ear has resulted in considerable lessening of the granulation tissue and the discharge of pus. The amount of dizziness in this patient was unusual and, I believe, was due to the setting up of serous labyrinthitis from too much manipulation of the membranous labyrinth. While in this case the labyrinthitis appeared to subside, it is conceivable that such a condition might lead to the destruction of both labyrinthine and cochlear functions.

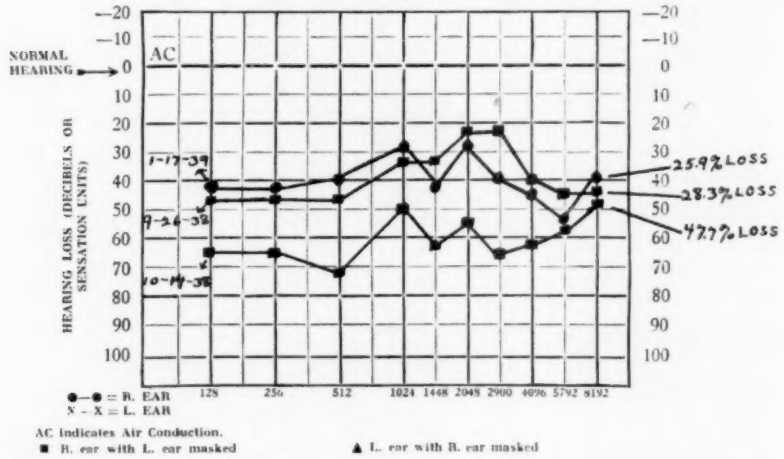

Chart 4 (case 5).—Audiograms showing the hearing in the right ear before and after operation on Sept. 30, 1938.

At present, there is no dizziness except on quick movement of the head; the fistula reaction is active and the wound entirely healed. Although improvement of hearing has not been demonstrated audiometrically, the patient asserts that she has much better hearing. This is probably largely due to the considerable lessening of the tinnitus since the operation and the improvement of hearing in the left ear.

CASE 6.—N. C., a woman aged 38, a hairdresser, had noticed gradually increasing deafness in the right ear for twenty years, with severe tinnitus, and increasing deafness of the left ear since an abdominal operation five years previously. For the past few years she had had considerable treatment of the ears, including inflation, without improvement of the hearing. A history of abscesses of the ears or familial deafness was not elicited. The tonsils had been removed about twelve years previously. The patient had not had operations on the nose or chronic

TABLE 5.—*Audiometric Recordings Before and After Operation on the Right Ear on Oct. 12, 1938 (Case 6)*

Audiometer Frequencies	Right Ear					Left Ear				
	9/26/38	10/22/38	11/5/38	12/5/38	12/12/38	9/26/38	10/22/38	11/5/38	12/5/38	12/12/38
128.....	65	58	43	47	52	77	68	73	70	68
256.....	70	48	70	54	54	73	69	75	70	66
512.....	85	47	45	48	57	76	82	77	70	70
1024.....	80	37	48	48	42	67	70	64	63	68
1448.....	80	37	43	41	42	68	70	68	63	63
2048.....	65	35	46	42	42	39	45	55	38	48
2900.....	65	57	53	35	32	46	43	47	43	48
4096.....	77	72	74	53	55	67	75	68	77	73
5792.....	100	100	100	100	100	68	65	100	67	100
8192.....	100	100	100	100	100	100	100	100	100	100
Loss of hearing for speech, %	61.6	31.7	37.1	35.7	37.3	48.8	52.5	52	45.6	49.9

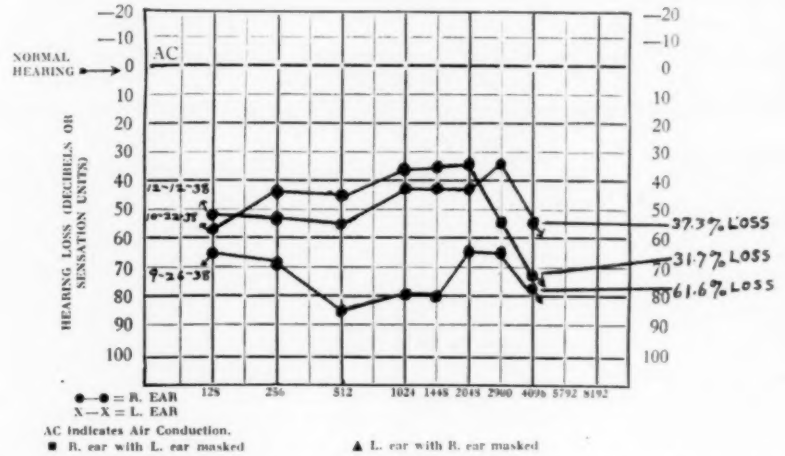

Chart 5 (case 6).—Audiograms showing the hearing in the right ear before and after operation on Oct. 12, 1938.

nasal symptoms. Tuning fork tests showed profound deafness of the right and considerable deafness of the left ear, with normal bone conduction in both ears and lateralization of tone to the right. Examination showed the right drum normal except for slight thickness. On the posterior quadrant of the left drum was a round elevated area appearing like a blister, which was apparently a thin layer of skin covering an old perforation in the drum and which had been ballooned outward by repeated inflation of the ear. An audiogram on Sept. 26, 1938, showed a loss of hearing in the right ear of 61.6 per cent and in the left ear of 48.8 per cent.

On October 12 operation was performed on the right ear. Exposure of the membranous labyrinth of the external semicircular canal caused considerable dizziness and much improvement in hearing, measured by voice tests. For several days after operation the dizziness was severe, with vomiting and nystagmus. This condition was improved somewhat by removal of some of the gauze packing and loosening of the remainder. The severe dizziness persisted for several weeks after discharge from the hospital but gradually became less, and as it subsided

the hearing improved. On October 22 an audiogram showed a 31.7 per cent loss of hearing in the right ear and a 52.5 per cent loss in the left. On December 12 the loss of hearing was 37.3 per cent in the right ear and 49.9 per cent in the left.

Comment.—Although there is still a loss of hearing in the right ear of 37 per cent, the practical improvement has been more than is indicated by the audiometer record. This patient is immensely pleased with the result obtained, as she gets along well with ordinary conversation, and has given up the idea of getting a hearing aid, which she had planned before the operation to obtain. She is planning to have the other ear, which still shows a loss of 49.9 per cent in hearing, operated on. It has now been four months since the operation, and, as the fistula reaction remains active, it seems likely that there will be no bony regeneration to cover the fistula.

TABLE 6.—*Audiometric Recordings Before and After Operation on the Left Ear on Oct. 19, 1938 (Case 7)*

Audiometer Frequencies	Right Ear				Left Ear			
	5/11/38	9/24/38	12/10/38	1/21/39	5/11/38	9/24/38	12/10/38	1/21/39
128	33	41	42	43	68	48	100	100
256	38	43	48	43	65	47	100	100
512	48	53	45	46	62	53	97	100
1024	58	62	63	62	67	62	95	96
1448	55	54	55	53	58	52	91	90
2048	56	60	58	51	76	84	100	90
2900	56	62	58	56	80	86	94	100
4096	62	67	73	55	86	90	100	100
5792	100	100	100	100	100	100	100	100
8192	100	100	100	100	100	100	100	100
Loss of hearing for speech, %	43.2	46.9	43.3	42 4	54.4	53.3	77.3	76

CASE 7.—L. H., a boy aged 14, first noticed deafness at 9 years of age. Since then his hearing had been rapidly getting worse in both ears with buzzing noises in both. In the past two years he had been studying lip reading and had gained considerable proficiency in it. A tonsillectomy was performed at 5 years of age. During his early life he had many abscesses, in both ears. A history of deafness in the family was not elicited. Both ear drums showed some thickening, retraction and scarring but no perforations.

Tuning fork and voice tests showed marked impairment of hearing in both ears, with probably decreased bone conduction and lateralization of tone to the right. An audiogram on Sept. 24, 1938, showed a 46.9 per cent loss of hearing in the right ear and a 53.3 per cent loss in the left.

On October 19 operation was performed on the left ear. When the bony labyrinth had been removed and the membranous labyrinth exposed, there was no dizziness and no improvement in hearing. More extensive removal of the bony labyrinth in an attempt to cause dizziness and give improvement in hearing while the patient was on the table resulted in perforation of the membranous labyrinth. The opening was covered promptly by the skin flap and the operation completed. There was no postoperative dizziness or nystagmus. After the operation the hearing

was obviously worse, and on December 10(nearly two months after operation) an audiogram showed a 77.3 per cent loss of hearing in the right ear and a 43.3 per cent loss in the left. Subsequent tests, up to the time of writing, showed no improvement of hearing in the ear operated on. The bone conduction, however, remained as before operation, definitely present but decreased from the normal.

Comment.—The patient was not suitable for operation because of poor bone conduction and a considerably weakened or dead labyrinth. The condition of the labyrinth was not determined before operation. It appears desirable to do a caloric test on all patients as a preliminary to the operation, to determine the status of the labyrinth. A dead labyrinth should be a contraindication for the operation. Too much zeal in exposing the membranous labyrinth in this case resulted in its perforation. However, it seems more likely that the breaking of the

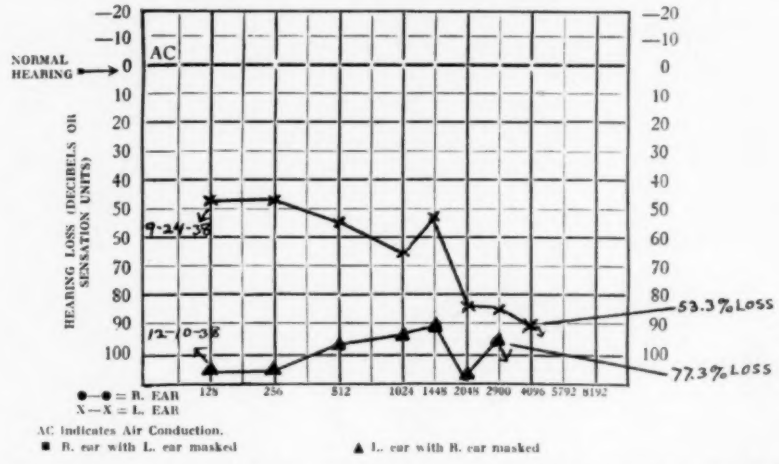

Chart 6 (case 7).—Audiograms showing the hearing in the left ear before and after operation on Oct. 19, 1938.

ossicular chain by excision of the head of the malleus caused the increase in deafness rather than the opening of the dead labyrinth. The cochlear function certainly was not destroyed, as there was response to some of the audiometer frequencies and the bone conduction was not lost.

CASE 8.—F. B., a married woman aged 40, first noticed deafness of the right ear six years previously, in association with an acute sinal infection. Since then the deafness had steadily increased, with increasing tinnitus, and for the past four years there had been gradually increasing deafness and tinnitus of the left ear. There was no dizziness. The patient had had much treatment by otologists of various cities and by an osteopath, with no improvement. There was no history of abscesses in the ears. The father had had a similar type of deafness and died at 75. Scarlet fever had left the mother partially deaf in one ear. Three older sisters had no deafness.

Examination showed both ear drums normal except for slight thickness. Tuning fork and voice tests showed profound deafness of the right ear and considerable of the left, with normal bone conduction in both and lateralization of tone to the right. On inflation air entered both middle ears easily and well. On Nov. 19, 1938, an audiogram showed a 62.4 per cent loss of hearing in the right ear and a 40 per cent loss in the left. On December 29 an audiogram showed a 61.1 per cent loss of hearing in the right ear and a 41.6 per cent loss in the left. Another check-up, preliminary to operation, showed on Jan. 5, 1939, a 61.9 per cent loss in the right ear and a 40.3 per cent loss in the left ear.

On January 11 operation was performed on the right ear. Exposure of the membranous labyrinth of the external semicircular canal caused moderate dizziness

TABLE 7.—*Audiometric Recordings Before and After Operation on the Right Ear on Jan. 11, 1939 (Case 8)*

	Right Ear					
Audiometer Frequencies	11/19/38	12/29/38	1/5/39	2/6/39	2/11/39	2/14/39
128	64	53	56	19	27	13
256	59	56	55	24	23	13
512	72	73	74	47	32	37
1024	72	68	68	32	32	27
1448	87	84	85	42	41	37
2048	89	86	90	44	41	37
2900	85	92	90	69	68	67
4096	100	100	100	100	100	100
5792	100	100	100	100	100	100
8192	100	100	100	100	100	100
Loss of hearing for speech, %	62.4	61.1	61.9	32.8	28	27.2
	Left Ear					
Audiometer Frequencies	11/19/38	12/29/38	1/5/39	2/6/39	2/11/39	2/14/39
128	37	27	26	43	41	40
256	37	33	33	40	46	49
512	37	42	41	37	41	42
1024	47	48	46	48	51	52
1448	53	53	55	57	52	53
2048	64	66	63	65	60	64
2900	63	66	57	55	59	60
4096	74	82	78	79	73	85
5792	100	62	100	100	100	100
8192	100	100	100	100	100	100
Loss of hearing for speech, %	40	41.6	40.3	40	40.5	41.9

and considerable improvement in hearing measured by voice tests. Near the finish of the operation, in smoothing off some of the bony edges with the drill, the delicate skin flap of the posterior canal wall was caught in the burr. This not only resulted in severely tearing the flap but also caused a ragged laceration across the drum. The edges of these lacerations were approximated as accurately as possible and the remnants of skin deflected so as to cover the malleus, the incus, the epitympanic space and the fistula of the external semicircular canal. The skin was held closely in place by small pieces of gauze mesh. The operation was followed by moderate dizziness for a few days. When the packing was all removed, on the tenth day, the patient noticed distinct improvement in hearing, and the fistula reaction was active. On February 6 an audiogram showed much improvement in the ear operated on, particularly for the low tones, the right ear showing only a 32.8 per cent loss, an improvement of 29.1 per cent since the operation, and the left ear still showing a loss of 40 per cent. One week later the hearing of the right ear was further improved, to a 27.2 per cent loss.

Comment.—It is of course entirely too soon after operation to tell what will be the final result for this patient. At present, the hearing is greatly improved, and the patient is immensely pleased with the result. The lacerated drum and skin of the posterior wall of the canal are healing well, and it looks as if the drum would entirely heal. There is still some swelling of the tissues throughout, and it seems possible that as this swelling subsides hearing will be further improved. The fistula reaction is active, and as it has shown no lessening during the six weeks since operation it seems probable that the fistula will not be closed by bony regeneration. In this case also the practical improvement in hearing was much greater than that indicated by the audiograms, 35 per cent.

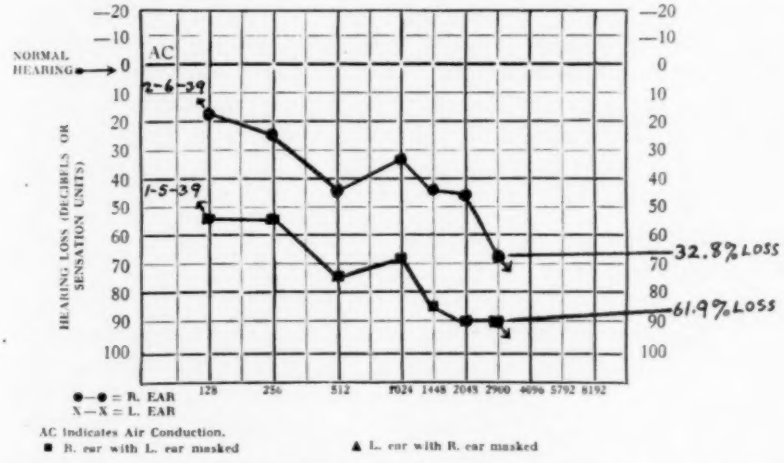

Chart 7 (case 8).—Audiograms showing the hearing in the right ear before and after operation on Jan. 11, 1939.

CONCLUSIONS

An analysis of the 8 cases here reported in which an attempt has been made to improve the hearing by means of fistulization of the labyrinth will reveal results of varied character and will perhaps permit certain deductions or conclusions. I should classify the results which have been obtained as excellent in 2 cases, as there has been considerable improvement in hearing for the critical frequencies as recorded by the audiometer and, what I believe is more important, a practical improvement of hearing which has been extremely gratifying to the patient. In another case (the first reported) the improvement has been fair, sufficient to give the patient considerably more comfort in his occupation as a clerk and to make him plan to have the other ear operated on to gain additional improvement. In 2 other cases the hearing was made worse at first by the closure of the fistula. On

reoperation one of the patients has been much pleased at the improvement thus far obtained, and the audiometer has shown further improvement at each weekly interval since the operation, five weeks ago. The other patient operated on a second time showed satisfactory improvement for a few weeks, but recently this improvement is being lost, and the eventual outcome does not look promising.

In 2 of the 8 cases hearing by air conduction has been made worse, although the bone conduction remains unchanged from the preoperative level. The failure has been due partly to the unsuitability of the cases for the operation and partly to the opening of the membranous labyrinth. In 1 of these cases there was no useful hearing in the ear operated on before operation, and the patient is unaware that his hearing is worse; as the bone conduction has not changed, he can still obtain hearing by a bone conduction hearing aid if he desires one. In the other case, although the hearing is worse, the patient appears to be concerned only about the tinnitus, which had been distressing and which was not improved by the operation. In the case in which the labyrinth was fistulized after radical mastoidectomy little or no improvement has been recorded, although the patient insists that her hearing is better.

One thing has been impressive in operating on these patients and that is the importance of adhering strictly to the described technic if good results are to be effected. There are many points at which a slip-up may occur and cause failure or partial failure to obtain a good result. It is easy to lacerate the delicate skin of the posterior wall of the canal or to lacerate or perforate the drum in the removal of the sulcus tympanicus. In separation of the malleus from the incus preliminary to amputation of the head of the malleus the incus may become loosened and require removal. The proper handling of the external semicircular canal is of the greatest importance. The bony labyrinth must be removed in a groove or trough shape by means of the burr to an extent sufficient to expose a rather wide area of membranous labyrinth without injury to it. Then, of extreme importance is the fitting of the tympanomeatal cutaneous membrane over the fistula so closely as to make contact of this membrane with the membranous labyrinth. This close fitting of membrane over the fistula may have much to do with the prevention of its subsequent closure by bony regeneration.

DANGERS OF THE OPERATION

Mortality.—There should be no fatality if strict asepsis is maintained. Even though the membranous labyrinth were destroyed or the dura perforated, septic labyrinthitis or meningitis would not occur in the absence of infecting organisms.

Injury to Cartilage.—It is possible that cartilage of the ear may be injured or cut, but, again, if strict asepsis is observed chondritis or perichondritis will not develop.

Injury to the Labyrinth.—Destruction of the labyrinthine and possibly also of the cochlear functions may result from injury or rupture of the membranous labyrinth. On the other hand, it seems possible that an opening of the membranous labyrinth, if sealed promply by the tympanomeatal cutaneous membrane, may heal itself without impairment of either the labyrinthine or the cochlear functions.

Injury to the Facial Nerve.—The facial nerve may be paralyzed if injured, but this should not occur with careful technic. It has twice been my experience to expose the facial nerve adjacent to the external semicircular canal without resultant paralysis, perhaps because in this area the operative work is done so slowly and carefully that even though the facial nerve is exposed it may be recognized and not injured, so that paralysis will not result.

Injury to the Tympanic Membrane.—The tympanic membrane may be perforated or lacerated but should heal promptly in the absence of infection.

Dislocation of the Incus.—The incus may be accidentally removed. If the rest of the operation is successfully performed its removal may cause little or no impairment of the result. However, if bony regeneration closes the labyrinthine fistula, the impairment of hearing will be greater than before the operation, because the break in the ossicular chain will prevent sound impulses from reaching the internal ear through the normal conducting channel. It is assumed that in cases suitable for operation fixation of the stapes in the oval window prevents the conduction of sound impulses. However, the degree of fixation of the stapes varies in cases of conductive deafness so that in many of them some impulses are transmitted through the stapes. Accidental dislocation of the incus will prevent such impulses from getting through, and a decrease in hearing will result if the fistulization of the external semicircular canal is not successful.

Decrease of Hearing.—A decrease of hearing, then, appears to be one of the most serious consequences of an improperly performed operation. If, however, there has been no practical hearing before operation, the further impairment of the hearing will be of little concern. Even if there has been some useful hearing before the operation, the nature of the condition is such that progressive impairment (sometimes rapid) of the hearing is to be expected, and a sudden decrease caused by an accident at operation may be only hastening the eventual outcome.

POSTOPERATIVE REACTIONS AND COMPLICATIONS

No serious postoperative reactions or complications have been observed in my cases.

Dizziness.—The dizziness that occurs with the patient on the operating table when the labyrinth is opened is usually prolonged for a few

days. The amount of this vertigo is dependent to some extent on the firmness of the gauze packing overlying the fistula and probably also on the amount of trauma which the membranous labyrinth has received during exposure. In 2 of my cases severe dizziness followed the operation, lasting four to six weeks. I attributed this prolonged reaction to the setting up of serous labyrinthitis from trauma to the membranous labyrinth. In both cases it subsided and has left an active fistula reaction. In the majority of cases the dizziness gradually subsides within a few days, so that when the gauze packing is removed, on the eighth day, the patient is able to walk out of the hospital without help.

Pain.—Postoperative pain is usually so slight as to require no sedatives for its control.

Temperature.—There is little or no rise in temperature after operation. In one of my cases active follicular tonsillitis developed on the second postoperative day. The temperature rose to 102 F. for three days, but thereafter it became normal, and the tonsillitis subsided in the usual time.

Healing of the Wound.—Considerable thick exudative moisture is present in the operative area, covering the walls of the canal and the drum. Granulation tissue forms in the posterior part of the wound, in the excavated mastoid area and around the border of the concha. Sometimes this is excessive and requires burning down with trichloroacetic acid (25 per cent) or a strong solution of silver nitrate. In my cases the operative area remained moist, with granulation tissue which required burning for two to four months. Eventually the wound becomes dry and is entirely covered with skin and the opening of the wall of the canal shrinks to its normal size, leaving no indication that the ear has been operated on.

State of Hearing During Convalescence.—During the week immediately following operation, while the gauze packing remains in the ear, little idea of the degree of hearing can be gained. After the packing is removed, however, if the operation is successful, a distinct improvement is usually noticeable. However, improvement may be delayed several days or weeks longer, because of reaction of the tissues. Trauma to the tympanic membrane and the reflected skin of the wall of the canal may cause such swelling and edema, with perhaps some hemorrhage into the cavity of the middle ear, that improvement of hearing is delayed until this reaction has subsided. Furthermore, the development of severe labyrinthitis also may delay the improvement. Probably the greatest improvement in hearing is present while the patient is on the operating table when the labyrinth is opened. Afterward the reactions of the tissues cause a lessening of the hearing from that observed with the patient on the table, and although there is further steady improvement as the reactions of the tissues subside and healing occurs, it is

doubtful if the improvement in hearing again reaches the level observed while the patient is on the operating table. When the wound has dermatized completely and all exudate ceased, the hearing has probably reached its height of improvement. This takes from two to four months. When the operation is rendered unsuccessful by closure of the fistula by bony regeneration, hearing is improved during the first week or two after operation, but the improvement is rapidly lost thereafter until it becomes worse than before the operation, as the fistula closes. In the 2 cases of mine in which this occurred the improvement in hearing had been lost and the fistula closed, as determined by absence of the fistula reaction, at the end of four weeks.

If one can draw a conclusion from results obtained in such a small number of cases, it is that definite improvement of hearing in properly selected cases of conductive deafness can be obtained by fistulization of the labyrinth according to the technic described by Lempert.[3] In evaluating the results obtained it is important also to consider the effect of the operation on the tinnitus nearly always associated with the deafness. In the cases reported here in which there has been an improvement in the hearing there has also been a lessening of the tinnitus, and this has been particularly pleasing to the patient.

What amount of improvement in hearing may be expected in patients properly selected and operated on is a question that may properly be asked. From my own experience I believe an improvement of 35 per cent may be expected, or an improvement of 40 to 45 decibels in the middle and lower frequences. When this is realized it is evident how important it is to operate in such cases of progressive deafness before the deafness has become too great.

To determine accurately the amount of improvement that may be obtained with this operation will require the experience of many operators in many additional cases. It is important, therefore, that more cases be reported, with observations and comments, as fast as possible, in order that more knowledge may be gained of a therapeutic procedure that appears to have given great advancement in the treatment of a condition that was formerly discouraging. Considerable experimental research also is necessary to clarify some of the doubtful points associated with the physiology and pathology of the mechanism of the internal ear. For instance, there is still doubt about the way in which the hearing is improved when the labyrinth is fistulized—whether the sound waves go directly through the fistula and give impulses to the perilymph or whether they still go through the drum, the cavity of the middle ear and the round window, with the fistula acting only to mobilize the perilymph.

Further experiences with this surgical treatment of progressive deafness will aid in solving the problems associated with it. Cases

in which the procedure is successful will establish it more firmly as an important therapeutic advancement, and those in which it fails should only emphasize the great importance of proper selection of patients and accurate surgical technic.

SUMMARY

Permanent improvement of hearing in cases of chronic progressive deafness by fistulization of the labyrinth depends on the maintenance of the fistula by the prevention of bony regeneration of the labyrinthine wall.

Closure of the fistula can be prevented by adherence to an exacting surgical technic.

To obtain the desired improvement the cases for operation must be selected with great care. Bone conduction must be good; the vestibular function must be normal, and the tympanic membrane must be in good condition.

A report is made of 8 cases in which labyrinthine fistulization was performed according to the technic described by Lempert.

In 4 of these cases considerable improvement of hearing is revealed by audiometric examination. In 2 cases the hearing in the ear operated on has been made worse, partly because of faulty operative technic and partly because the type of deafness was not suitable for improvement by this procedure. In the remaining 2 cases there is little or no change in the hearing.

Possible dangers of the operation are mentioned and postoperative reactions and complications discussed.

END RESULTS OF INTRANASAL OPERATION FOR MAXILLARY SINUSITIS

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Surgical treatment of chronic maxillary sinusitis may be either radical or conservative; definite and rigid rules cannot be laid down, for treatment must be suited to the individual patient. There are patients for whom only a radical operation will suffice, but usually, conservative measures will restore the antrum to a normal state.

To determine the type of operation to be used, a careful preoperative study of the maxillary sinus should be made. This examination is not complete without the use of an antroscope. By means of this instrument, the presence of polyps, cysts and tumors, as well as the condition of the lining mucous membrane, often can be determined.

To estimate the benefits derived from the conservative treatment of chronic maxillary sinusitis, I [1] studied in 1927 the histories of 385 patients so treated. An effort was made to determine the causative background and thereby to ascertain whether certain types of disease of the antrum would respond to conservative methods. Most of the patients could not give the date of the onset of symptoms, nor did they know whether their symptoms accompanied a cold in the head. Many were able to trace the infection in the antrum to a diseased tooth or to its extraction. In 22.5 per cent of the cases, the infection clearly followed extraction of abscessed molars. In 63 cases, a fistula extended through the alveolar process and into the antrum.

Antral infection of dental origin was usually marked by several characteristics: (1) The infection was confined to the antrum and was unilateral; (2) the upper sinuses were not involved; (3) the pus was foul smelling and similar to that associated with infection caused by the colon bacillus; (4) polyps had not formed, and (5) healing was unusually rapid after institution of suitable drainage and ventilation. In all the cases the infection in the antrum cleared, and in many the

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This and the following papers were read as part of a Symposium on Final Results of Operations for Chronic Suppurative Paranasal Sinusitis at the Forty-Fifth Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., Chicago, May 10, 1939.

1. Hempstead, B. E.: Intranasal Surgical Treatment of Chronic Maxillary Sinusitis, Arch. Otolaryng. **6**:426-430 (Nov.) 1927.

alveolar fistula closed, after curettement. In the other cases, it was necessary to close the fistula by utilization of some form of flap. All fistulas eventually were closed.

A review of the 385 cases shows that it was necessary to do a Caldwell-Luc operation in 2 cases. In both cases the antrum was filled with polyps. In 2 cases, osteomyelitis of the maxilla followed; 1 patient died, and 1 recovered. The condition of the patient who died was complicated by severe bilateral bronchiectasis and marked inanition. Stenosis of the tear duct associated with epiphora was seen in 3 cases. In 4 cases, membranous closure of the window occurred, and a second operation was necessary.

In 1921, Barlow [2] reported the results of intranasal operation in the treatment of maxillary sinusitis in 100 cases. A modification of the Mikulicz operation was used in all cases. Forty-seven per cent of the patients were cured. Six per cent were finally operated on radically. Seventeen per cent were not improved, and 36 per cent were improved but not cured.

In 1922, Lyons [3] reported a study of 100 cases of empyema of the antrum of Highmore occurring after extraction of teeth. The modified Mikulicz operation was used for all patients but 1, for whom the Denker operation was used.

Goodyear [4] in 1934 reported a series of 84 cases in which he had done the intranasal operation. He had previously been an advocate of the Caldwell-Luc type of operation, but after a trial of the intranasal method he stated, " . . . my experience convinces me that in many cases the end-results in a properly performed intranasal operation are equal and even superior to those obtained by the more radical approach through the canine fossa." He stressed the point that not only should the window be brought well forward and downward but it should be carried as far posteriorly as possible. This last procedure is avoided by most operators because of fear of injury to a branch of the sphenopalatine artery. This accident occurred only once in his series of operations. In my experience, injury of this blood vessel has been a most troublesome complication and has necessitated ligation of the external carotid artery. Goodyear also advised firm packing of the antrum with gauze impregnated with 5 per cent iodoform powder.

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2. Barlow, R. A.: The Value of Conservative Intranasal Drainage for Chronic Empyema of the Antrum, Minnesota Med. **4**:445 (July) 1921.

3. Lyons, H. R.: Empyema of the Antrum of Highmore Secondary to Extraction of Teeth: A Study of One Hundred Cases, J. A. M. A. **78**:486-487 (Feb. 18) 1922.

4. Goodyear, H. M.: Chronic Antrum Infection: Treatment by Intranasal Antrum Operation and Packing; Clinical and Experimental Results, Arch. Otolaryng. **20**:542-548 (Oct.) 1934.

In this series of operations, secondary enlargement of the opening was done in 6 instances, and in 1 case it was necessary to operate three times.

Tucker [5] called attention to the occurrence of the major part of the pathologic change common to sinal disease in the mucous membrane. He stated the belief that conservative measures should be employed. In a series of 673 patients having chronic maxillary sinusitis who were operated on by the intranasal method, it was necessary to do a Caldwell-Luc or some other type of radical operation for 6. In 47 cases in this series, or 7 per cent, the condition was of dental origin. It is interesting to note that in 9 cases in which polypi could be seen in the sinuses at operation, the polypi could not be seen later. It seems to me that this observation is proof that drainage and ventilation permit the diseased membrane to return to normal and that its exenteration is not always necessary.

Stevenson [6] in an excellent article reported 192 cases of chronic maxillary sinusitis. He came to the conclusion that intranasal surgical treatment is the method of choice for primary attack in all cases of chronic antral infection. Ninety-four and two-tenths per cent of his patients recovered completely after this procedure.

Williams [7] in an excellent paper in 1935 gave credit for the intranasal approach to Mikulicz, who described the operation in 1886. It was later modified by Krause. The method now used is a modification of Krause's operation. Williams presented a review of the literature and reported the end results obtained for 200 patients having chronic maxillary sinusitis treated at the Mayo Clinic in 1926. He felt that sufficient time had elapsed to judge whether the good results obtained might be permanent. Surgical approach by way of the inferior meatus was the treatment for all the patients.

Williams divided the 200 patients into two groups. In one group, of 123, he had to depend on questionnaires. In the other group, of 77, he had the opportunity of examining and determining the results of the operation. For 11 patients of the latter group, results were not satisfactory. For 5 of these 11 patients, enlargement of the window produced a perfect result. Another patient obtained a clinical cure but subjectively was not relieved. There was 1 failure in a case of bilateral

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5. Tucker, J. C.: Conservative Surgical Treatment of Chronic Maxillary Sinusitis, Ann. Otol., Rhin. & Laryng. **37**:631-633 (June) 1928.

6. Stevenson, W.: Chronic Maxillary Sinusitis: An Analysis of One Hundred and Ninety-Two Cases That Came to Operation, Arch. Otolaryng. **13**:506-531 (April) 1931.

7. Williams, H. L.: Intranasal Operation for Chronic Maxillary Sinusitis: End Results in Two Hundred Cases in Which the Principles of Küster Were Employed, J. A. M. A. **105**:96-100 (July 13) 1935.

bronchiectasis. One patient's infected frontal sinus had been overlooked. When this had been treated, a cure was obtained. One patient suffered from intranasal bleeding after operation, which necessitated packing. An ethmosphenoid infection occurred, but with appropriate treatment a cure was obtained. For 2 other patients a Caldwell-Luc operation had been advised elsewhere, but institution of dry suction and abandonment of daily lavage resulted in a cure. Eventually, 92.3 per cent of patients within this group were cured of their afflictions.

Of the group of 123 patients not seen after operation, 104 reported that they had experienced no return of their former symptoms. Four of the 19 patients who reported unsatisfactory results were undoubtedly, and 1 probably, allergic. Two had severe bronchiectasis. The poor end result for another was the result of undiagnosed frontal sinusitis. A poor result was obtained for 1 patient who had severe diabetes associated with ozena. One patient who had a large choanal polyp was not cured. Severe osteomyelitis was the cause of another failure. For 2 patients, failure of the surgeon to close an alveolar fistula was the cause of a poor result. For another patient complete relief was obtained after a Caldwell-Luc operation had been performed and for another after operation on the opposite side. Four patients reported poor results; no cause for the failure of operation could be determined.

SUMMARY

Two things should be considered in the treatment of every patient having maxillary sinusitis: first, cessation of discharge and, second, restoration of the antral mucous membrane to as nearly normal a condition as is possible. Unnecessary destruction of the ciliated epithelium should be avoided. A functioning mucous membrane is to be preferred to scar tissue.

A careful preoperative study should be made to rule out the presence of a dentigerous cyst or of a granuloma arising from an infected tooth. A recent study of a series of cases with Dr. Austin, of the dental department of the Mayo Clinic, has convinced me of the necessity of cooperation between the rhinologist and the dentist in conditions that affect the maxillary sinus.

The presence of allergia calls for special treatment. The infection should be cleared up, but a dry antrum cannot be obtained until the allergic condition has been brought under control.

The presence or absence of infection in the upper sinuses should be determined. The antrum may be merely acting as a reservoir; if such is the case, draining it alone would not cure the infection.

Postoperative care is of the greatest importance. Many poor results are directly caused by inadequate treatment. My colleagues and I, of

the Mayo Clinic, prefer to use dry suction and completely to avoid lavage with aqueous solutions. The patient should be seen daily; the contents of the antrum should be aspirated, and the suction tip should be moved freely in the window to maintain its patency. The patient should not be dismissed from treatment until the antrum is dry. The antroscope should be used for patients whose convalescence is slow.

CONCLUSIONS

1. The intranasal window operation is easily and quickly accomplished, with the patient under local anesthesia.

2. Turbinate tissue is not lost when it is performed.

3. Reaction to it is much less severe than that following the radical operation.

4. It causes a minimal amount of injury to the lining membrane, which is permitted to return to as nearly normal function as is possible.

5. Polypoid and badly infected membranes have been seen to return to normal after drainage and ventilation have been established.

6. Use of the antroscope is a great aid in determining the necessity of conservative or radical measures.

7. The high percentage of good results obtained with this operation justifies its use in the treatment of certain patients having chronic maxillary sinusitis.

8. Closure of the alveolar fistula is necessary if a good result is to be obtained.

9. This type of operation is not suitable for antrums having partitions and dense antronasal walls.

10. This type of operation is not suitable when antrums contain foreign bodies or for an antrum in which the presence of a tumor is suspected.

In this report 1,634 cases are gathered from the literature. A good result was obtained in 97 per cent of these cases by the intranasal antral window.

END RESULTS OF INTRANASAL OPERATIONS ON THE ETHMOID, FRONTAL AND SPHENOID SINUSES

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The estimate of the end results of any surgical procedure must be somewhat relative. The experience of many operators, however, when properly correlated, may justify some definite conclusions in establishing the value of an operation in the light of its final results.

One must always be careful in the selection of such data if one is to arrive at reliable results. The experience of some is often found to be untrustworthy for various reasons. The old maxim that experience teaches fools is not the truth but rather the opposite, that only the wise profit by experience.

One may almost postulate at the outset in discussing this subject that the results of intranasal operations on the sinus vary directly with the skill and training of the operator. It is, as every one knows, a difficult surgical field, and perhaps nowhere in the body is it more necessary for a surgeon to develop the sense which the late Dr. Osler called "eyes in your fingers." This clinical sense can be developed only in those who have a thorough knowledge of the anatomy of the region and have had in addition a long experience in operations on cadavers. One must also know definitely the various pathologic processes and be able to judge accurately the pathologic conditions which are amenable to operation. For example, a type of infection of the ethmoid sinuses producing slowly obliterating osteitis with resultant atrophic changes in the membrane presents a condition for which intranasal operation can offer no prospect of cure. On the other hand, the suppurative hyperplastic and polypoid forms can be successfully relieved or cured by an intranasal operation. Of late a little tendency to disapprove of all forms of intranasal operation on the sinuses has been propagated among the laity and in some cases among various groups in the medical profession. Such opinions are not war-

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ranted but have found some reason for their existence in the bad results observed from imperfect and incomplete operations.

The persistent tinkering in the removal of polypi and in the partial ethmoidectomies that have come under my own observation easily explains the wrong impression which has prevailed, and I should like to emphasize my conviction that there is about the same justification for partial ethmoidectomy as there is for partial mastoidectomy, even granting the possibility of only part of the area being involved. When the cells are only partly exenterated one has established a certain road for infection to those remaining, and even if that were not so, one has left an irregular ragged surface of half-opened cells which can never heal. Some will become closed with scar tissue and be certain to give subsequent trouble.

I should like to report a case briefly to illustrate that.

About fifteen years ago a woman came to New York to consult the best oculist in that city. She had had a condition which had seriously damaged her left eye, so much so that she had no vision left. She came with a history of having had an ethmoidectomy.

Finally she fell into the hands of an oculist who could not find any other possible cause; so he sent the patient to me to have the sinuses reexamined. I found that the whole posterior ridge of the ethmoid sinuses on the left side, as well as the sphenoid sinus, was much diseased. There was only a mass of granulation tissue and pus there, the most obvious focus ever seen. I could see it without the pharyngoscope or anything else. I advised immediate operation, cleaned it out as thoroughly as I could and opened the sphenoid sinus. The visual acuity was restored to 20/40, which had been considered hopeless.

The exponents of the external operation may say that all intranasal operations are incomplete. That is so in a good many cases, but from a long experience on the cadaver I can state that in the great majority of cases cells can be sufficiently removed to give adequate drainage to the few that are left. In all dissections of cadavers my colleagues and I used to split the head after the intranasal operation on the ethmoid sinuses, and in nearly all cases we found some drains in the cells that were there. The exception to this is a type of shallow anterior ethmoid cell extending out over the roof of the orbit. This cell is often missed in the external operation as well, a fact which I have proved by a good many secondary external operations.

Let me now consider more specifically the results of surgical efforts in the frontal, ethmoid and sphenoid sinuses. The intranasal operation on the frontal sinus has always one purpose, viz., to enlarge the nasofrontal duct to provide better drainage and enable one to carry out intrasinal treatment. Attempts are made sometimes to treat this sinus alone by removing the anterior end of the middle turbinate and a few anterior ethmoid cells, a rasp being inserted and the passage

enlarged forward. I confess that I have never found this a satisfactory procedure and have almost abandoned it. The ethmoid sinuses are practically always involved with the frontal; so I prefer to do an ethmoidectomy and have the frontal opening undisturbed. I always pass an applicator or a cannula through the natural opening into the frontal sinus and find it stays open provided I have all the cells removed behind the nasal process. Subsequent treatment can then be carried out, and unless there is complete degeneration of the frontal mucous membrane a satisfactory recovery follows.

Let us now consider the various types of pathologic change in the ethmoid and sphenoid sinuses amenable to operation. Suppuration in this area in the acute stages rarely calls for surgical treatment unless there is a rupture into the orbit and in that case it should be treated by an external operation. In cases of chronic steady purulent discharge satisfactory surgical results follow, but a great deal of after-attention is required. A discharging frontal sinus may keep the area of the wound continually infected, and until it is cleared up healing will be unsatisfactory. One may frequently find it necessary to remove exuberant granulations, and unless the suppuration in the frontal sinus can be controlled the end result will not be satisfactory. I can remember only 1 instance in which I finally had to do an external operation on the frontal sinus to clean up the discharge.

The next type of pathologic condition to consider in the ethmoid sinuses is the hyperplastic form. In many cases it is secondary to a low grade infection and is not necessarily allergic. This is the type most often associated with disease of the eye, optic neuritis or some of the inflammatory changes in the choroid and iris. In the cases of optic neuritis operation as soon as possible is imperative. I should like to urge this necessity on all my oculist friends. I have seen in the past year the tragedy of loss of vision due to neglect in 2 young patients. I am certain of the correlation of optic neuritis with posterior sinusitis in many cases and have seen the sad results of delay in making diagnosis, especially in the cases in which both eyes are involved; the patients are shifted about with strong determination to consider the condition multiple sclerosis till it is too late. A week or ten days is as long as they should be left untreated, though occasionally one may make a fair recovery even after a month.

The intranasal operation on the ethmoid and sphenoid sinuses is the procedure of choice, and there is not a more spectacular result in the whole field of surgery than can be obtained in these cases if the patient is taken in time. In cases of recurring iritis or iridocyclitis also satisfactory results are attained when the focus of infection is located in the ethmoid or sphenoid sinuses.

I shall now consider the largest group of conditions amenable to operation, viz., those with polypoid degeneration. They are the ones with which most of the tinkering operations are done, and many of the patients have a session with a specialist about every three months. The intranasal operation must be done thoroughly, and then vigilance must be maintained for some time afterward; if this is done there is slight chance of recurrence. Once the area is covered with epithelium there will be little prospect of any further trouble. The patients themselves assume an attitude more or less of defeatism. Some doctors perhaps encourage them in doing that, but I have found them one of the most satisfactory types for intranasal operation.

A good many years ago a man came to New York, very much an invalid, supposed to have bronchiectasis. He was a farmer upstate and had practically had to give up his work. As a young man, 39 years of age, he almost resigned himself to a life of invalidism. His nose was literally filled with polypi. He could not breathe. Both antrums were full.

I made two sections, as I always do in such cases—I do a submucous ethmoidectomy, open the sphenoid sinuses and give them a little respite and do the double radical antrectomy at the next session. The patient made an excellent recovery, is practically well and has been able to do his work ever since.

I remember one time he was looking rather pensive, and I asked him what he was thinking about. He said, "I was thinking about the thirty-nine operations I had before I ever saw you."

In following the records of patients after intranasal operations one must consider the final results from a local and from a general perspective. The local effect will be a good breathing nose and comparative though not entire freedom from discharge. There will usually be some mucoid discharge which does not bother the patient much.

The presence of crusts or scabs afterward is the result of an incomplete operation, especially if the posterior part of the middle turbinate has been left. This interferes with drainage in the sphenoethmoid recess and allows an accumulation of secretion there. The patients are not immune to subsequent acute infections, but such infections are more amenable to treatment and do not last as long. The most troublesome after-result is closing of the sphenoid opening, especially if there is osteitis. This may necessitate a subsequent reopening, but, generally speaking, if it is opened wide enough at the first operation and carefully treated afterward a sufficient opening will be permanent. In cases of sinal headache there is usually some osteitis and the final result is not always satisfactory. This is equally true of the results of more radical operations.

The general results depend on the condition which the operation was intended to cure. In cases of asthma, for instance, antrectomy is usually needed as well, and if the condition is associated with polypoid

degeneration a thorough operation in both regions produces marked improvement in all cases and satisfactory cure in some. The percentage of good results with ocular complications is high. With other lesions due to focal infection in the sinuses, such as arthritis, the results have not in my experience been satisfactory. The patients often show marked improvement for a time, but they are prone to relapse. I have found this to be true even when the most radical sinal operation has been performed.

A focal infection in the sphenoid sinus is perhaps the most difficult to eradicate, and the surgery of this sinus deserves some special consideration. If the mucous membrane has not degenerated it may be treated by making a large opening in the anterior wall and hoping that resolution may take place by restoration of the membrane to normal function. If pathologic changes render it necessary to remove the membrane one is left with a cavity which must heal by granulations filling it or by epithelium covering a granulating surface on its walls. In the first instance, it usually becomes constantly infected with continuous discharge from broken-down granulations, and the process may go on for years. In order to offer much prospect of success one must take off as much of the anterior wall as possible and a good portion of the floor. In the second method of healing also the process will be greatly accelerated by the same radical removal of the anterior wall and the floor. In several instances I have seen adhesions between the floor of the sella and the sinal floor shut off a small cavity in the posterior part, which has always produced serious symptoms; so it would seem advisable in all cases of sphenoid sinusitis in which the membrane has been removed to do a fairly radical operation to facilitate healing and to prevent the occurrence of subsequent untoward results. This operation can be performed by the intranasal route as thoroughly as by the external.

In this brief résumé I have endeavored to show from my own experience the possibility of lasting benefit from intranasal sinal operations. I do not consider this the sole method by any means, as many patients can be properly treated only by the external route, but I rather deplore a tendency to advocate the external method as the only one which should be used in operations in this field. I deplore also the tendency to denounce all kinds of operations on the sinuses, for, while this anatomic field is difficult and variable, the many excellent results obtained may compare favorably with the benefits from operations in any region of the body.

END RESULTS OF EXTERNAL OPERATIONS ON THE MAXILLARY SINUS

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It is generally agreed that ideal surgical intervention consists of the adequate removal of a diseased focus with the least possible trauma to adjacent structures and with a minimum sacrifice of vital functioning tissue. It follows, therefore, that the more radical the procedure necessary for the accomplishment of the first objective the more difficult it becomes to attain the other two. Having these facts in mind one can realize how important it is to appraise the situation thoroughly in a given case before resorting to so-called radical surgical intervention.

Applying this logic specifically to the maxillary sinus and with a full realization of its implications, I have no hesitancy in stating that the Caldwell-Luc operation is the most satisfactory surgical procedure about the nasal accessory sinuses and the one which should yield the highest percentage of good results in conformity with the principles set forth at the beginning of this paper. This statement is based on the following facts: First, the technic is simple and easily carried out; second, the entire sinus is open to inspection, so that there can be no excuse for overlooking any pathologic tissue; third, complications and sequelae are rare, and, fourth, nasal function is in no way impaired.

Omitting from the present discussion the consideration of tumors, foreign bodies and fractures of the sinus as indications for the operation, one must confine one's studies to the pathologic processes affecting the lining membrane of the sinus, since a great deal depends on an accurate appraisal of the degree and extent of these processes. In addition, one's conclusions as to the effectiveness of this operation must be based on the relation of the local findings to the symptoms, a consideration of the patient as a whole and a determination of the degree of care and skill with which previous conservative treatment has been applied. Some of these factors have been thoroughly elaborated by Wherry,[1] Mithoefer[2] and others, so that it is superfluous for me to

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1. Wherry, W. P.: The Nasal Accessory Sinuses as a Focus of Infection: Evaluation of Various Diagnostic Methods, Tr. Am. Laryng., Rhin. & Otol. Soc. **41**:71, 1935.

2. Mithoefer, W.: Non-Operative Treatment of Nasal Sinus Disease, Surg., Gynec. & Obst. **60**:587 (Feb., no. 2A) 1935.

dwell on them at any length. The points on which I desire to lay the most emphasis in this paper are the diagnosis of the pathologic process, the importance of properly assessing the local complicating factors and the operation itself. But before going into detail on these items let me make it clear that I never advise a Caldwell-Luc operation unless I am satisfied that there exists within the antrum a degree of pathologic change which is beyond the hope of repair by any means short of complete removal and that the pathologic change so diagnosed is the cause of the symptoms for which the patient is seeking relief. These are the premises on which I base my indications.

Roughly speaking, the pathologic changes to which I refer may be divided into two groups: the one associated with various degrees of local symptoms of which the patient is aware and the second more or less silent or occult but associated with manifestations of disorders elsewhere in the body. The diagnosis of the former is usually simple. The most frequent symptoms are nasal discharge, obstruction to breathing, headaches and frequent colds. Usually there is a history of repeated attacks of coryza with or without acute sinal pain. The patient may have undergone various minor procedures, such as antral lavage, tamponade, removal of polypi and other intranasal operations, and the process has manifested cycles of comparative relief between attacks, according to the weather and the general status of the patient's health. Examination during an attack reveals a purulent or mucopurulent discharge, with or without polypi, thickened, red lateral pharyngeal bands, cloudiness of the antrums, usually more marked on one side, and marked obscurity of the shadow on a roentgenogram. Between attacks the findings may vary from comparative normalcy within the nasal passages to the presence of mucopurulent discharge, polypi and a red or glazed pharynx. In any event, regardless of the gross appearance, one finding is constant, namely, a persisting cloudiness of the antrum on transillumination or a definite obscurity of the normal sinal outlines on a roentgenogram or both. Even though irrigation may yield little or no secretion, when one considers the past history of the patient in connection with the roentgen findings the conclusion that the lining membrane of the sinus is not normal is inescapable. The last and most convincing means of diagnosis is the roentgenogram taken with a contrast medium in the sinus. Although some rhinologists claim to be able to determine the contour of the lining membrane by flat plates alone, I myself feel much more confident when I can see the outlines as they are sharply delineated by the introduction of iodized poppyseed oil. Whether the procedure is carried out by puncture through the inferior meatus, by direct cannulation or by displacement is of secondary importance. The consideration that carries the greatest weight with me is the appearance

of a thickened, irregular membrane at a time when the patient has the fewest subjective symptoms and a minimum of objective findings. In other words, if the sinus looks bad when the patient feels best, there can be no doubt that a chronic unresolved process is present which will yield to nothing less than radical extirpation.

As to the second group, namely, that in which the patient's local manifestations of sinal disease have been minimal but he is suffering from ailments suggesting a focus of infection, one has to weigh various factors carefully before definitely concluding that the sinus is at fault. The ailments to which I refer are chronic bronchitis, asthma, bronchiectasis, arthritis and neuritis. These conditions and, less frequently, others have been associated with chronic maxillary sinusitis to a greater or less degree. The question as to whether the latter is always the etiologic factor in the former, whether the two conditions have developed simultaneously or whether the sinusitis is purely coincidental has been thrashed out in the literature over a number of years. Time and space will not permit a thorough analysis of the many valuable contributions on this subject. Those who are interested will find them all abstracted in the reviews of the literature in the *Archives of Otolaryngology* for the past five years. Nevertheless, a brief summary may help to clarify the situation as it stands.

That infection may be transmitted via the lymphatics and the venous system from the antrum to the lower air passages as well as by direct aspiration has been proved experimentally by Mullin and Ryder [3] and Larsell [4] with the collaboration of Fenton and confirmed by others. Second, that in many cases chronic bronchitis, bronchiectasis or asthma, which defied other therapeutic measures, has cleared up or been largely ameliorated after radical operation on the sinuses has been attested by Clerf,[5] Cooke and Grove,[6] Manges,[7] Hodge,[8] Kartagener and Ulrich,[9]

3. Mullin, W. V., and Ryder, C. T.: Studies of the Lymph Drainage of the Accessory Sinuses, Laryngoscope **31**:158 (March) 1921.

4. Larsell, O.: Lymphatic Pathways from the Nose: Research Report, Arch. Otolaryng. **24**:696 (Dec.) 1936.

5. Clerf, L. H.: The Interrelationship of Sinus Disease and Bronchiectasis, with Especial Reference to Prognosis, Laryngoscope **44**:568 (July) 1934.

6. Cooke, R. A., and Grove, R. C.: Relation of Asthma to Sinusitis, with Special Reference to Results from Surgical Treatment, Arch. Int Med. **56**:779 (Oct.) 1935.

7. Manges, W. F.: Accessory Sinus Infection: Its Relationship to Mastoid and Lung Infections, Ann. Int. Med. **9**:547 (Nov.) 1935.

8. Hodge, G. E.: Relation of Bronchiectasis to Infection of the Paranasal Sinuses, Arch. Otolaryng. **22**:537 (Nov.) 1935.

9. Kartagener, M., and Ulrich, K.: Zur Pathogenese der Bronchiektasien: Bronchiektasien und Veränderungen der Nasennebenhöhlen, Beitr. z. Klin. d. Tuberk. **86**:349, 1935.

Kelley,[10] Harbert,[11] Watkins,[12] Davison,[13] Walsh and Meyer[14] and others. Certainly enough evidence has been forthcoming to prove the close relation in a large percentage of cases. When failures have resulted after operation on the sinuses the fault has been with the surgeon in neglecting to investigate the individual patient thoroughly enough. An analysis such as was made by Goodale[15] reveals many sources of error which only careful study can eliminate. Harbert[11] adequately summarized the subject when he said that differences in reports on asthma were due to

> (*a*) absence of controls in reporting . . . cases, (*b*) differences in criteria of diagnosis and standards of cures, (*c*) generalization from too few cases, (*d*) observation over too limited a period of time, (*e*) failure to properly evaluate . . . factors such as allergy. . . .

That seems to sum up the case pretty thoroughly.

With reference to arthritis, neuritis and other painful conditions suggesting a focus of infection, the evidence as to cause and effect is less convincing than in connection with bronchial infections. While post hoc, ergo propter hoc testimony has been offered by some excellent observers, scientific or experimental proof is still scanty. Nevertheless, focal infection has been accepted by most physicians and proved at least clinically in many excellent theses. However, as applied to the maxillary sinus the subject is still a matter of conjecture. The only rational way to evaluate the role of the maxillary sinus in these conditions, as well as in the bronchial conditions, is to determine whether the sinus is normal and if it is found to be abnormal just what degree of change is present. Also, it is highly important that the history of the development of all the symptoms be thoroughly studied, since time bears great weight. The situation here is not as simple as in the case of a suspected tooth or tonsil, the removal of which on slender evidence may be justifiable in an effort to eradicate every possible source of infection. One cannot honestly advise a radical operation on the antrum on the basis of a mere suspicion of slight cloudiness or haziness in a

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10. Kelley, S. F.: The Incidence of Sinusitis and Nasal Polypi in Bronchial Asthma, Laryngoscope **46**:692 (Sept.) 1936.

11. Harbert, F.: A Review of the Relation Between Sinusitis and Pulmonary Disease, U. S. Nav. M. Bull. **34**:52 (Jan.) 1936.

12. Watkins, A. B. K.: Oto-Rhino-Laryngological Considerations in Bronchiectasis, M. J. Australia **2**:118 (July 25) 1936.

13. Davison, F. W.: Chronic Sinusitis: Its Relation to Chronic Bronchitis, Pennsylvania M. J. **40**:821 (July) 1937.

14. Walsh, F. W., and Meyer, O. O.: Coexistence of Bronchiectasis and Sinusitis, Arch. Int. Med. **61**:890 (June) 1938.

15. Goodale, R. L.: An Analysis of Seventy-Five Cases of Bronchiectasis from the Viewpoint of Sinus Infection, Ann. Otol., Rhin. & Laryng. **47**:347 (June) 1938.

roentgenogram. How should one then be guided? When the history reveals a previous sinal infection of sufficient degree to have necessitated more or less therapy and one which impressed itself on the patient in spite of a long symptomless interval, one may seriously hold the sinus accountable for the constitutional condition for which he seeks relief. This is particularly true when roentgenograms reveal a lining mucosa that definitely exceeds the normal in thickness. Semenov [16] in his excellent work on the surgical pathology of the sinuses has shown that "thickening in excess of 2 mm. is associated with deep seated degenerative changes in 50 per cent of the cases." And when, in addition, cultures from aspirated irrigating fluid yield bacteria that are particularly pathogenic when injected into experimental animals, one may feel even

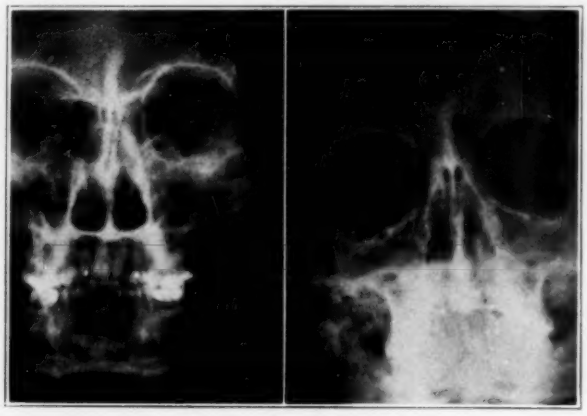

Fig. 1.—Roentgenogram of a man aged 25 with bilateral pansinusitis with polypi and pus. A bilateral Caldwell-Luc operation with transantral exenteration of the sphenoid and ethmoid sinuses and intranasal operation on the frontal sinus was performed.

more certain that the sinus is the seat of a chronic infection which is more than likely the focus sought. Certainly in doubtful cases, especially those in which a clear history of preceding sinusitis is lacking, it should not be too much trouble to carry out this test. Another valuable aid to diagnosis which has perhaps not been employed as much as it should is the measurement of the emptying time of the sinus, as developed by Proetz. When there is considerable delay in the expulsion of the injected contrast medium one is safe in assuming that ciliary activity is below normal, which in itself is definite evidence of disease.

16. Semenov, H.: The Surgical Pathology of Nasal Sinusitis, J. A. M. A. **111**:2189 (Dec. 10) 1938.

Fig. 2.—Specimen from the case illustrated in figure 1, showing edematous and cystic degeneration of the mucosa.

The only fly in the ointment in connection with what has thus far been stated is the question of allergy, either as the predominating or as a complicating factor. On this point I fear there is still considerable divergence of opinion. Semenov [16] found manifest allergy in 17 per cent of his cases and equivocal allergy in 35.4 per cent. These findings far from being of negative value to the clinician are, in my opinion, extremely significant. Seventeen per cent is not as large a proportion of definitely allergic mucosae as one might imagine from the stress that has been laid on allergy in general. The majority of these cases could undoubtedly have been eliminated in the beginning by the history, the general status of the nasal mucosa, and the results of cutaneous tests and of examination of the aspirated sinal fluid. As for the 35.4 per cent labeled instances of equivocal allergy, even if the preoperative diagnosis of specific sensitivity were lacking, one would still be justified in oper-

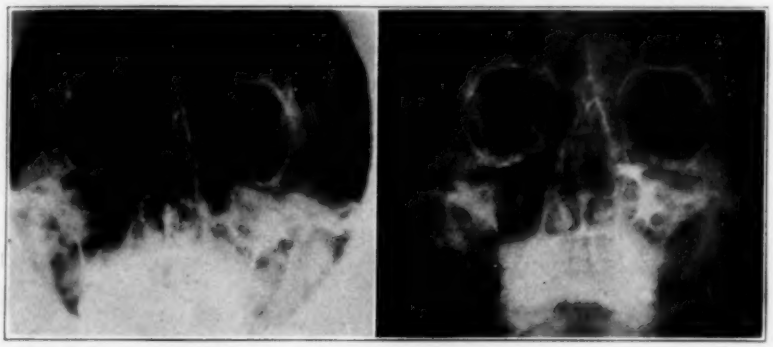

Fig. 3.—Roentgenograms of a man aged 32, with chronic postnasal drip, frequent colds and loss of weight. A Caldwell-Luc operation revealed extensive polyposis. A comparison is shown of films made with and without iodized poppy-seed oil.

ating, because the secondary infection had reduced the antral mucosa to a state beyond recovery even had the allergic factors been discovered and removed. This does not imply that the possibility of allergic factors should be ignored. On the contrary, I believe that all rhinologists agree on their importance and make every effort to uncover and eliminate them. The important point is that one must not lay too much stress on allergy, unless it is manifest and unequivocal, to the exclusion of true infection, particularly in dealing with a sinus suspected of being a focus of infection.

Having discussed diagnostic criteria as a basis for the radical operation on the antrum I come now to the operation itself. I stated in the beginning that the procedure was simple and without danger. However, I do not wish to imply that it can be attempted in an indifferent manner

or carried out without due attention to many details, which mean the difference between a prompt recovery and delayed convalescence, with annoying complications and possible sequelae. The points which I like to stress are (1) minimum infiltration of the soft tissues with the anesthetizing solution; (2) minimum trauma with retractors; (3) complete removal of all palpably diseased tissue, as well as areas not definitely normal; (4) thorough hemostasis; (5) drainage per rubber tube, and (6) as little postoperative manipulation as possible.

Postoperative edema of the face, in my opinion, is due to one or all of three factors, namely, distention of the tissues by the injected fluid, too much pressure with the retractors and postoperative packing. Since minimizing the first two of these and entirely eliminating the third, I

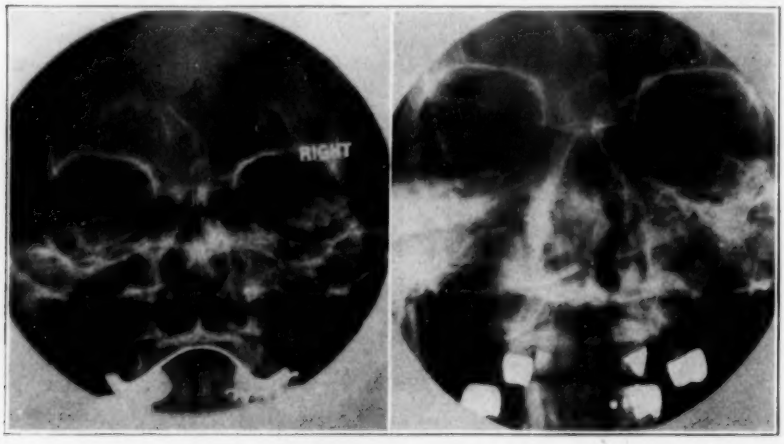

Fig. 4.—Roentgenograms of a man aged 44 with chronic suppuration of the maxillary and ethmoid sinuses with recurring polypi. Pansinusitis on the right was revealed by a Caldwell-Luc operation, and transantral exenteration of the sphenoid and ethmoid sinuses was carried out.

have had little edema to contend with. In practically all my cases the slight swelling of the cheek which appears within twenty-four hours after operation has completely subsided within three days and has never caused the patient the slightest inconvenience. Complete and adequate anesthesia may be obtained by blocking the posterior dental, infraorbital and posterior palatine nerves. In addition I use cocaine plugs in both the middle and the inferior meatus and inject the line of incision with a 1 per cent solution of procaine hydrochloride. Prolonged pressure with retractors is avoided by removing them at intervals and allowing the soft tissues to resume their normal position. As for postoperative packing, I can see no good reason for its use in the antrum. Packing ordinarily is employed for the control of hemorrhage or to prevent a

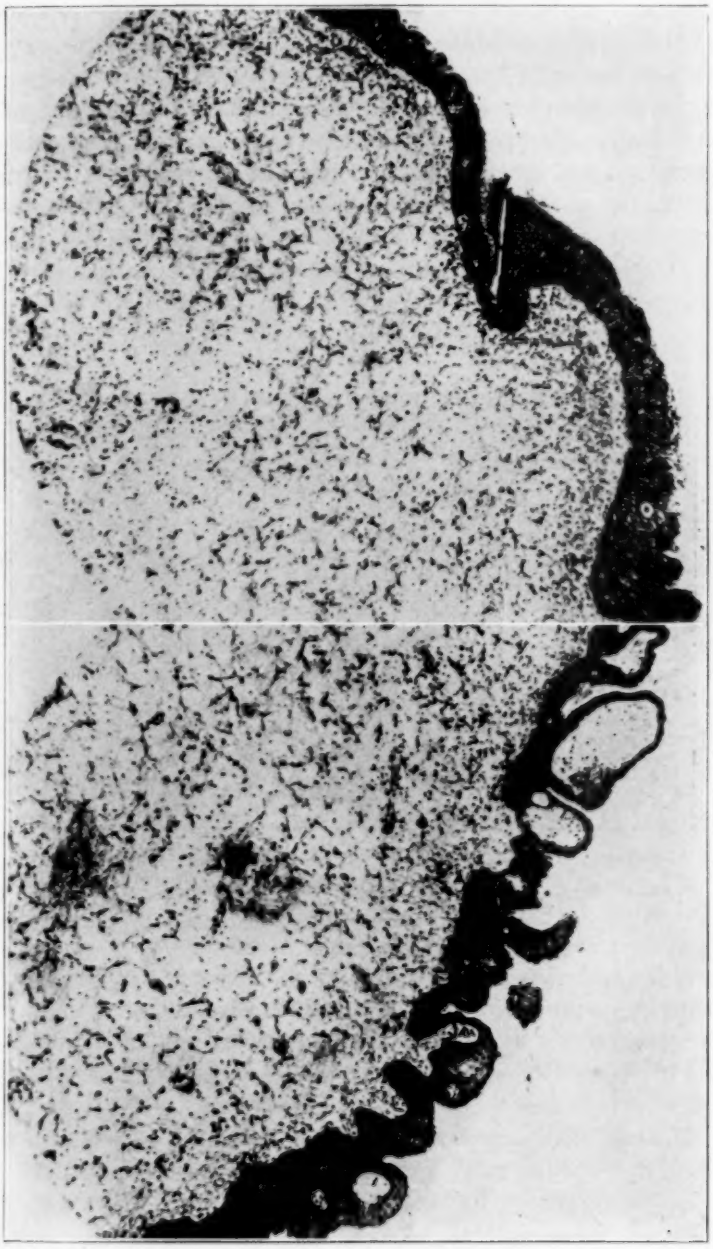

Fig. 5.—Specimen from the case illustrated in figure 4 showing (above) metaplasia of the mucosa and an edematous substrata and (below) cystic degeneration in the mucosa and destruction of the surface epithelium.

cavity from collapsing. Neither of these reasons is valid in the operation under consideration. The sources of bleeding in my experience are usually the mucous membrane itself, one of the communicating vessels of the alveolus or a branch of the internal maxillary artery which penetrates the posterior wall of the sinus. The bleeding from the soft tissues is easily controlled by pressure with the hemostat or ligature and the bleeding from the bone by mashing the aperture with a curet or gouge. In any event, if hemostasis is complete at the conclusion of the operation there is little danger of postoperative bleeding. Concerning the question of removal of the sinal lining, I am of the opinion that all macroscopically diseased mucosa, including doubtful areas, should be removed. Membrane that looks soft and red, even though it is thin and

Fig. 6.—Roentgenograms of a woman aged 49 with asthma. Chronic hyperplasia of the maxillary and ethmoid sinuses was treated by a Caldwell-Luc operation and transantral ethmoidectomy.

fairly well attached to the bone, should be taken out, because it is likely subsequently to undergo the same degenerative changes found in the other, more grossly affected, portions. If one has ever seen normal-looking mucosa in situ one can never forget its pale, almost transparent, glistening appearance. As for drainage, I use a fenestrated rubber tube of maximum diameter, which extends from the posterior wall of the sinus, through the surgical fenestra, up to the anterior naris. If the cheek has any tendency to swell on the day after the operation the tube is removed and not replaced; otherwise, it is left in place for forty-eight hours. Postoperative treatment consists of the application of an ice bag and administration of sedatives if required. When the tube is removed the antrum is aspirated via the inferior meatal fenestra by means of a curved cannula directed toward its floor. Irrigations are employed when

necessary. Occasionally a weak solution of alcohol may be used to remove old clots and counteract odor. As a rule, however, the less irrigation the better. The patient may use an ephedrine spray to relieve swelling of the inferior turbinate, which in some cases is troublesome.

Postoperative sequelae have, in my experience, been rare. I have never seen a postoperative cyst of the cheek, such as is reported numerous times in the foreign literature, nor have I ever encountered lasting anesthesia of the cheek, teeth or lip. The longest that any patient has complained of this symptom has been six months. In most cases the primary numbness wears off within two to three weeks. Occasionally

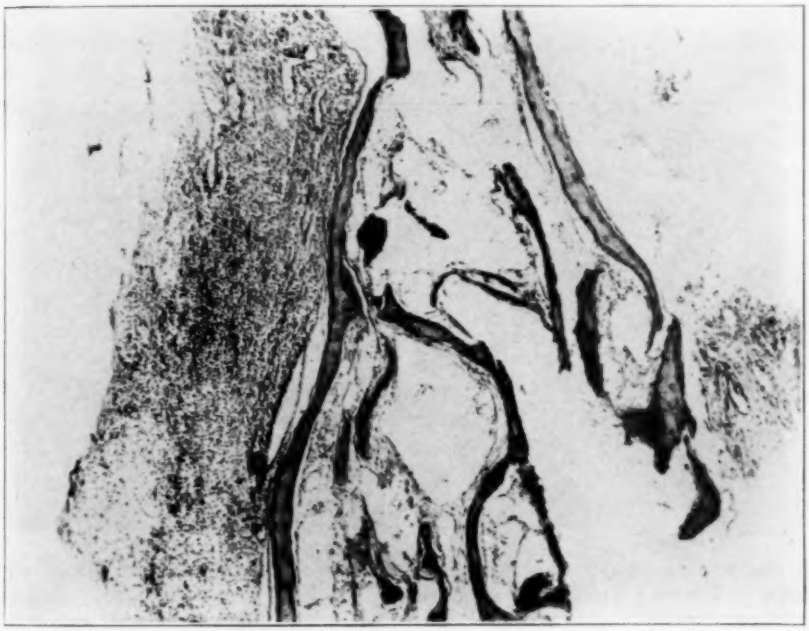

Fig. 7.—Specimen from the case illustrated in figure 6, showing destruction of epithelium, periostitis and cystic degeneration.

the gingival incision tends to remain open, but in such instances I have found the cause to be inadequate intranasal drainage, due to swelling around the fenestra. In no instance, however, did the opening fail to close spontaneously after appropriate local treatment was instituted.

As to complicating factors at the time of operation, the one most frequently encountered is coexisting chronic ethmoid, sphenoid or frontal sinusitis requiring surgical intervention. My procedure in such cases is to follow the Caldwell-Luc operation with transantral exenteration of the ethmoid and sphenoid sinuses, which is easily carried out. The anterior cells, however, must be reached intranasally. The entire naso-

antral wall of the middle meatus is removed, a wide passage being thus provided from the operative field into the nasal cavity. If the middle turbinate is hyperplastic or tends to obstruct drainage it is removed in part or completely as the case may be. In such cases, the opening in the inferior meatus is omitted, and the rubber tube introduced into the antrum is pulled through the enlarged middle meatus into the nasal cavity. Packing is never employed. If the frontal sinus is diseased it is dealt with through a separate external incision.

In looking over several hundred histories from my private files over twenty years of cases in which the diagnosis was chronic maxillary sinusitis I am struck by the ultra conservatism which characterized my treatment in the earlier cases in contrast with the more aggressive attitude of recent years, and I can truthfully say that the latter stand

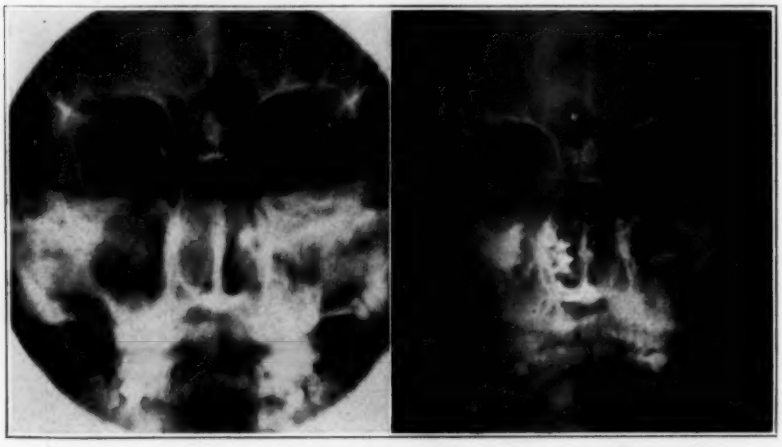

Fig. 8.—Roentgenograms of a girl aged 17 with a cough and asthma. Injection with iodized poppyseed oil shows thickening of the nasoantral wall. Thickened polypoid mucosa, chiefly on the nasoantral wall, was removed by a Caldwell-Luc operation.

has more than justified itself. I could cite any number of instances in which patients returned with recurrence of symptoms year after year despite most careful conservative treatment, and always in such cases my findings revealed the same recurring discharge, the same cloudy appearance on transillumination and the same obscure roentgenograms. It was only when I began studying these cases more carefully, coordinating the history, the findings and the roentgenograms made with the aid of contrast mediums, that I began to appreciate the hopelessness of prolonged and repeated conservative treatment and the necessity for more radical procedures. My results for suppurative conditions, with or without polypi, have been at least 90 per cent perfect. The only instances in

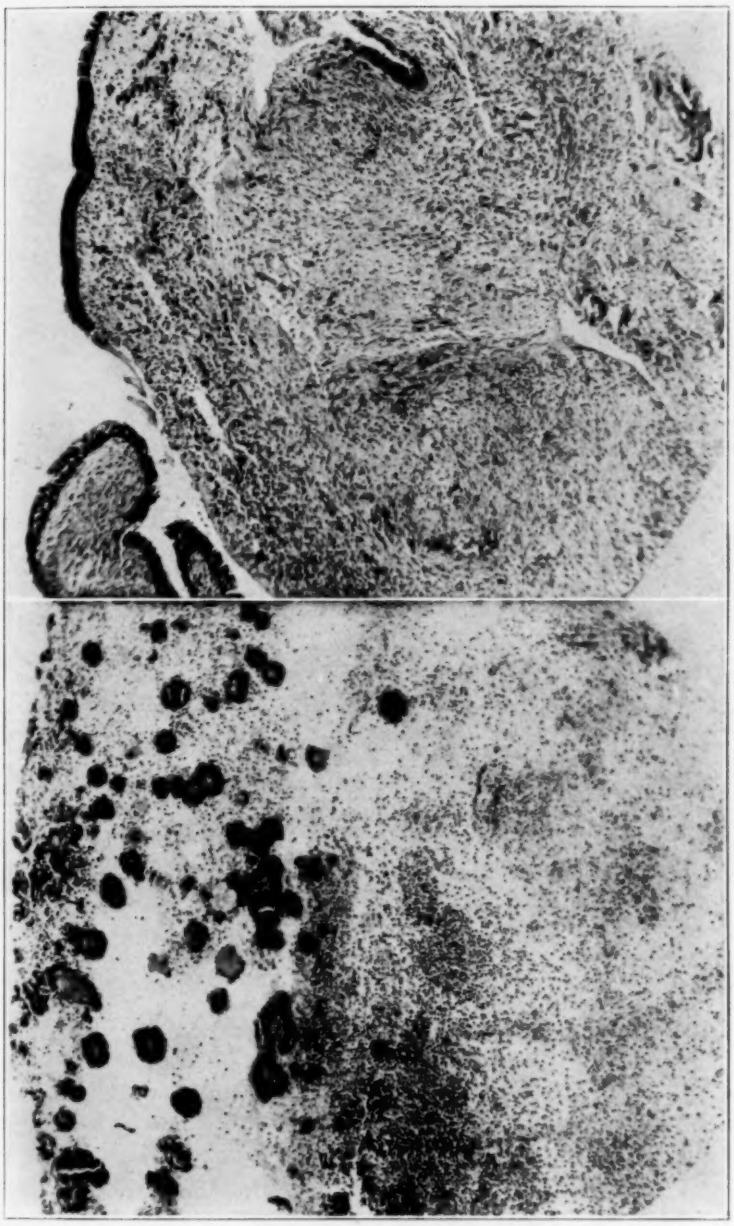

Fig. 9.—Above, specimen from the case illustrated in figure 8, showing enormous thickening and infiltration of the substrata and loss of mucosa. Below, specimen from a case of chronic maxillary sinusitis with referred pains, chronic cough and loss of weight, showing loss of epithelium, massive infiltration and areas of necrosis.

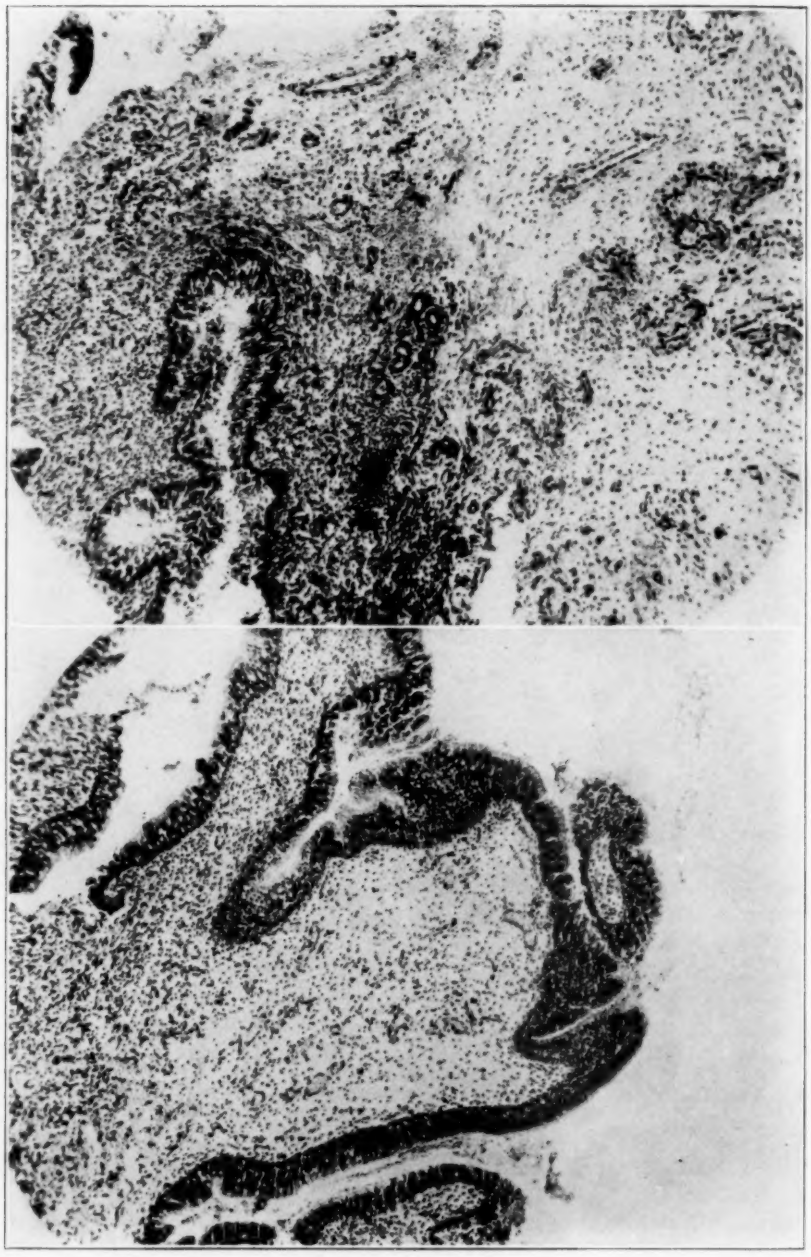

Fig. 10.—Specimen from a case of chronic sinusitis in which a previous incomplete operation had been performed, showing (above) chronic inflammatory changes with fibrosis and (below) thickened mucosa and polypoid formations.

which polypi or discharge has reappeared were those in which coexisting ethmoiditis was inadequately treated. My results for chronic bronchitis, asthma and other nonspecific pulmonary conditions have been as good as those of the authors I have quoted, although the actual number of cases is not large enough to constitute an impressive statistical study. Nevertheless, I can state most emphatically that I have never been disappointed in the operation when my preoperative diagnosis was based on sound facts and careful study and when possible allergic factors had been thoroughly investigated and taken care of.

In conclusion I say again that the radical operation on the antrum has in my hands proved to be the most uniformly successful and satisfactory operation of the entire sinal repertoire and that success in its application depends on the scrupulous care with which the local process is studied and the relation to constitutional factors appraised, the degree of skill applied in its performance and the attention that is paid to disease in the other sinuses.

END RESULTS OF EXTERNAL OPERATIONS ON THE FRONTAL, ETHMOID AND SPHENOID SINUSES

M. F. ARBUCKLE, M.D.
ST. LOUIS

In arranging this symposium the president, Dr. Lillie, expressed a desire to have presented at this meeting a thorough review which would cover as completely as possible the results obtained by operations on the various sinuses. The subject of "External Operations on the Frontal, Ethmoid and Sphenoid Sinuses" was assigned to me.

The task of checking up on the cases has been much greater than anticipated, and I am afraid that I have not been able to examine the records in anything like all the cases available, even in my own practice. I find that from 1921 to 1939 I have operated for sinal disease in approximately 600 cases in the Barnes Hospital alone. During this study I have been able to check up on a sufficient number of cases to gain adequate and most interesting information. One of the most interesting facts brought forth in this study is the tremendous decrease in the number of operations on the sinuses. This is undoubtedly the direct result of increased knowledge of the manifestations of allergic reactions. The evidence that so-called sinusitis frequently is of allergic origin and sometimes the result of endocrine disturbance is so important and so convincing that I have digressed in order to discuss these features.

Rhinologists have seen the rise of popularity of surgical treatment of sinal disease on the basis that infection was the underlying cause in all cases. During all this time in a certain number of cases relief was not obtained by such treatment. They then found that many such conditions are not of infectious origin but are allergic. Accordingly the popularity of operative treatment has decreased almost to the exclusion of certain types of surgical intervention in favor of antiallergic treatment and, occasionally, endocrine treatment.

A large and rapidly increasing group, of which I am one, feels that allergy is a most important factor in the cause, or one might say is

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Read as part of a Symposium on Final Results of Operations for Chronic Suppurative Paranasal Sinusitis at the Forty-Fifth Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., Chicago, May 10, 1939.

"the cause," of the complaint in well over half of all persons suffering with symptoms of sinal disturbance and that when the condition is correctly diagnosed and properly treated operation is contraindicated except when such a person has an infection in his sinus of a type for the relief of which surgical intervention is indicated. Therefore, the necessity of differential diagnosis between infectious sinusitis and allergic sinusitis is obvious.

There is no reason why a person with allergy should not get an infection. Indeed, he is more likely to get a troublesome infection than is one with normal mucosa. When such a person does get an infection which requires surgical drainage, the mere fact that he has allergy should not be allowed to interfere with his getting the proper treatment. Furthermore, I have found that many allergic persons on whom I have operated for the relief of suppurative sinusitis and who have continued to have allergic manifestations from time to time feel that they have been markedly benefited by the operation, because their allergic reactions are not attended with the pain and other disabling symptoms which they formerly had and infections occur less frequently and do not disable them as formerly.

A comparison of the methods of studying sinal disease now and in the preallergy days is of interest. There is one fact, so well set forth by the example of Greenfield Sluder, which has not been altered, viz., the importance of a thorough knowledge of the anatomy of the sinuses. He was under the impression until late in his life, too late for him to have an opportunity for real work on another basis, that infection was the sole underlying cause of sinusitis. It is now known, of course—and I speak for myself—that many of the clinical entities described by him as of infectious origin in reality are part and parcel of allergic manifestations. Such for example are "vacuum headache," "lower half headache" and "the neck-arm-shoulder syndrome." Roentgen studies of the sinuses were made in his day, to be sure, but differentiation was usually not made between the density caused by thickness of the membrane due to allergy and by that resulting from infection.

In 1922 I made notes in the records of numerous patients in the wards of the St. Louis Children's Hospital in which I described pus recovered from the maxillary sinuses, for example, as either thick and white or varying between green and yellow, with the comment that with the latter a more virulent type of infection seemed to be present but also the patients showed improvement after operation more uniformly than did those from whose sinuses the thick white pus had been recovered in preoperative study. This antedated microscopic study of the cellular composition of the nasal secretions and of the blood for eosinophilia, and I well remember Dr. Hansel's early efforts along this

line and how foolish and useless I thought they were. In my own practice, smears from the nasal secretions are now studied in every case. In addition, blood smears are often made, and the thyroid function is studied, in searching for the cause not only of symptoms referable to the nasal sinuses but of unexplained vertigo and tinnitus. It has been my experience that in hypothyroidism the appearance of the interior of the nose often suggests the condition, and many times a basal metabolism test made because of this symptom alone confirms the diagnosis, although the typical bodily changes usually seen with hypothyroidism, such as increased fat, pallor, dry skin and dry falling hair, are not always present. The blood pressure is likely to be below normal and the free hydrochloric acid in the gastric juice low or absent. The outline of a contrast medium (iodized oil) in the sinuses is likely to be smooth with allergy and irregular or jagged with infection. Cultures may be sterile with allergy but not with infectious sinusitis. The history, of course, is of first importance, and to be dependable it must be taken by the rhinologist himself. Even then the facts needed for a diagnosis may in some cases be elicited with difficulty or not at all, and one may be obliged to go through with tests, even to the point of trial and error and sometimes total exclusion by hospitalizing the patient. A helpful and simple method of study for detecting the unknown cause of headache ascribed by the patient and his doctor to sinusitis is a daily chart of food intake with a record of attacks of headache entered at the time of occurrence.

This may all sound complicated, and at times it is, but I have found that when necessary it pays in the long run. In attempting to differentiate between infection and allergy as a cause of headache, I am convinced, the help obtainable from a specialist in the field of allergy is of the greatest importance to the patient and to the rhinologist. In many cases the cause is so obscure that long and patient search is necessary; Dr. C. M. Stroud, of St. Louis, has helped me in a number of such cases, particularly with a group of patients apparently sensitive to molds, for whom the diagnosis was proved by a change of residence and by cutaneous tests.

For drainage of the ethmoid and sphenoid sinuses I do Sluder's operation. It is the safest and most efficacious method of operation on these sinuses that I know of. I feel that it is not possible for me to do intranasal operations on the frontal and maxillary sinuses as satisfactorily as external operations. Surgical intervention on the sinuses is difficult at best. When it is done without visualizing the field on which one is operating one may, with a certain amount of reason, expect poor results. For this reason, I prefer to operate on the sinuses by the external route whenever possible and always when opening the

frontal, maxillary or ethmoid sinuses in cases of osteomyelitis or of orbital abscess. For simple drainage of the ethmoid and sphenoid sinuses, Sluder's operation has proved satisfactory in my hands.

Operations on the frontal or maxillary sinus or the other sinuses, for that matter, in cases of allergic persons should be carried out only after thorough antiallergic treatment, except, of course, when the need for operation is so urgent as not to permit of delay. By this plan a large percentage of patients, who in the past would have been operated on, have responded most satisfactorily to antiallergic treatment, with the result that operation was rendered unnecessary. This has been found to be true in cases in which a few years ago one would have thought by all the rules that operation should be carried out. As a rule when allergic sinuses are operated on symptoms disappear for from six weeks to six months, usually for a period midway between, after which the allergic symptoms recur when the patient is exposed to allergens to which he is sensitive. With this clearly understood there is no reason why operations on the sinuses should not be carried out when indicated.

A few case reports will suffice to bring out some of the points I have in mind.

The first is that of J. F., a man aged 27 when he reported to me for treatment in 1928. His chief complaint was headache and frequent attacks of cold in the head. He had huge sinuses. The diagnosis of sinusitis of the maxillary and frontal sinuses, bilateral, was made. External operations on the frontal and maxillary sinuses were done. The results of the operation were not notably satisfactory, although thickened membrane and pus were removed from the sinuses opened. The patient was acquainted with one of the best known rhinologists in New York, who communicated with me frequently while I was carying out the treatment. Later he moved back to New York, and because of continued symptoms he was seen by this mutual friend. He was told that the treatment I had given him was all right as far as it went but that it had not gone far enough. Another operation on his frontal sinus was proposed and carried out with similar results. Then the rhinologist died, and when the patient was seen by his successor he was told, according to his story to me recently, that his second series of operations had been inadequate and that he needed further operation, which was carried out with identical results. On Aug. 5, 1938, ten and one-half years after I had first seen the patient, he came into my office, much the worse for wear physically, mentally and financially but with his headache as of old. It was apparent that the external walls of the frontal sinuses, which had been prominent when I had last seen him had been removed in New York, permitting the skin to fall back against the posterior wall of the sinus.

When he returned, his first statement was: "Well, here I am back again, still crazy with headache, but I haven't any money with which to pay you." My response was that if he would let me study him there would be no charge. I suspected that headaches were allergic, and my first step was to study smears from his nose. These were loaded with eosinophils. It was plainly evident from his

history that his headache was allergic, and when his nose was examined this opinion was supported by the findings. I showed him how to keep a daily chart of food intake of every sort and how to make entries of the occurrence of the attacks of headache. One month later the patient returned from a trip to the west coast to report to me with great pleasure and satisfaction that the source of his trouble had at last been found. He had discovered by referring back to the chart that every time he ate wheat flour or came in contact with wheat he had an attack of severe headache. On May 4, 1939, his wife called to report to me that if he ate white bread he had an attack of headache and that after they had discovered this and while he was abstaining from wheat flour, he had an attack of headache while passing through a large wheat field in South Dakota. So long as he avoided wheat he was all right.

On the other hand, I wish to report the case of R. M., a man of 22 when I first saw him on May 26, 1925. He had multiple infectious sinusitis and also asthma, with more or less continuous purulent secretions from his ethmoid and sphenoid sinuses. These sinuses were drained by the Sluder technic, with the result that his nasal symptoms were and still are remarkably relieved and he has practically quit having headaches or asthma. When he gets an acute cold and his nose is blocked and polypi begin to appear, he is entirely relieved with one or two local treatments and is kept comfortable.

Another case is that of E. H., a woman of 33 when first seen on Sept. 28, 1925, with pansinusitis with infection and allergy. She had terrific headache, and during the attacks she was disabled by the pain and vomiting which accompanied them. She had copious discharge of pus and moderate hypothyroidism. After all her sinuses had been operated on and she had been given thyroid and warned to refrain from taking alcohol and certain articles of diet, she made a satisfactory recovery and is still well so far as headache is concerned. The accompanying photograph demonstrates the lack of deformity from external operations on the frontal sinuses, although deformity is not infrequently a drawback in such operations when the incision is not properly placed.

C. C., a white woman, was 41 when seen July 28, 1926, with bilateral ethmoid, sphenoid and maxillary sinusitis with attacks of headache so extremely severe as to confine her to bed for as long as two weeks at a time, for the relief of which large doses of morphine were inadequate. The sinuses were operated on in 1926 according to the method referred to. I see the patient frequently socially, and she is still free of headache and delighted with the results of her operation.

In over 600 cases of operation, there has been but 1 death, that of a patient who had an abscess of the frontal lobe, which was a direct extension from an infection of the frontal sinus, and in this case the patient's family refused operation for several days, and the patient, when operated on, had been in a coma for three or four days.

There is no reason for any deformity or other unsatisfactory cosmetic result. Medication along the line of endocrine function undoubtedly helps to restore tonus and increase the resistance to infection.

Parenthetically, I should like to remark that I have seen a number of persons who had nasal cavities filled with polypoid tissue in the

early stage of development in whom the polypi have disappeared with antiallergic treatment and remained away until their growth was stimulated by another cold or continued exposure to some allergen. Polypoid tissue which has become fibrotic does not disappear with such treatment.

After reviewing this series of cases, my opinion already formed is borne out, i. e., that differential diagnosis of the cause of sinusitis is necessary before treatment is instituted, that when sinusitis is present

Photograph of patient E. H. after external operation on the frontal sinuses.

in an allergic patient treatment along antiallergic lines should be tried before operation, unless the patient has some condition, such, for example, as orbital osteomyelitis, which threatens his life. When operation on the frontal or maxillary sinuses is needed, external operation offers the best opportunity for thorough work and is followed by the most satisfactory results. Many patients who have a combination of infectious and allergic sinusitis require surgical intervention to obtain relief.

539 North Grand Avenue.

DISCUSSION OF PAPERS ON RESULTS OF OPERATION FOR CHRONIC SUPPURATIVE PARANASAL SINUSITIS

DR. FRANK J. NOVAK JR., Chicago: I feel that in handling any chronic antral infection caused by a dental disorder or its treatment, with the production of a fistula, deep, sharp curettage and an immediate flap operation to close the defect are essential.

DR. ARTHUR W. PROETZ, St. Louis: I am in complete accord with every word that Dr. Hempstead has said. Dr. Faulkner said, "Partial ethmoidectomy is just as unsatisfactory as partial mastoidectomy." To my mind, the two things are not comparable because of the difference in mechanics between the mastoid and the ethmoid. In the first place, the ethmoid is supplied with a functioning organ, the ostium, which one is only too prone to regard as a mere hole in the wall. It is supplied also with cilia, which not only can function but almost always do, even in badly infected sinuses. Dr. Barnhill, in his courses, has repeatedly brought out clearly that if a surgeon is allowed to operate to the best of his ability on a cadaver to remove all the cells that he can find and then begins to take the skull apart he will find that he has not got them all, in most cases. It is not the leaving behind of those few cells that produces the bad end results, but it is the opening of the skull so wide in looking for them that it can never again take care of itself.

The lining of the sphenoid sinus is sparsely supplied with glands. The air in the sinus changes only once every hour or so, and it can be kept humid and the cilia kept functioning by the few glands that exist there. If the whole of the face of the sphenoid sinus is taken away, including the ostium, it cannot close, try as it will. (Goodness knows it wants to close!) If one makes it impossible for it to close, so that a blast of air is continually entering and destroying whatever cilia might tend to regenerate, one has put it in such a condition that it can never take care of itself and there is always a residue of more or less thickened, sticky secretion, made so because the air has access to it. That secretion, under those conditions is always a fine culture medium. The first breeze that comes along reinfects the sinus, and this happens again and again.

DR. EUGENE R. LEWIS, Los Angeles: I think attention should be directed to the patient who has the disease. This symposium left me with the impression of a composite picture of most of the materials that I can remember having been presented in these meetings for the last twenty-five years. I think the precedent should be carefully relegated to the past, and the members of this society should attempt to devote themselves to something new in its place.

DR. BURT R. SHURLY, Detroit: There are some guinea pig hospitals and guinea pig physicians in this country who would do a good thing for themselves by broadening out and becoming more humanitarian, recognizing that the patient is an individual and must be studied from that standpoint.

In many hundreds of operations for sinal diseases, the procedure outlined by Dr. Hempstead has been exactly mine.

DR. WILLIAM L. CULBERT, New York: It was mentioned that either a part or all of the middle turbinate can be removed, which of course can be, and is, easily done, but I think that the middle turbinate is the center of the physiologic structure of the nose, and sometimes when one sees a patient who has had exenteration of all the sinuses for pansinusitis one discovers that the nose has been exenterated rather than the sinuses.

The middle turbinate, I believe, can almost always be saved, no matter what else is being done in the nose.

DR. SAM E. ROBERTS, Kansas City, Mo.: After one has attended and participated in these meetings for twenty-five years, it is a great satisfaction to see a more conservative view being taken on sinal disease. I defy anybody to do a complete exenteration of the ethmoid sinuses. It simply cannot be done, nor can one do a complete mastoidectomy. There are certain cells in various places that one cannot reach.

DR. JOSEPH C. BECK, Chicago: The pathologic changes of the bone in the sinuses are to be considered first. For instance, if one has had a virulent infection to begin with and has had localized thrombotic areas in the bone that will require a long time for exfoliation, how can one expect by removing the membrane to have a healing of the process? There are small tracts underneath, as can be shown by the microscope if not by the naked eye. The mucous membrane itself, as Dr. Furstenberg showed, has undergone sclerotic changes, both sclerosis of the vessels and thrombosis, which can be seen in the specimens examined. There is the secret of the failures, the underlying pathologic changes.

DR. THOMAS E. CARMODY, Denver: One does not wish to treat such conditions conservatively or radically but to treat them rationally.

DR. LEE M. HURD, New York: To do a good ethmoidectomy, one first must do a subsection of the flaccid septum, so that one can get a diagonal view of the ethmoid area. The next step is to take out all the middle turbinate. Then one is perfectly safe and can get out most of the ethmoid cells.

DR. FRENCH K. HANSEL, St. Louis: I should like to emphasize the importance of routine studies of the nasal secretions. Just as among children, I feel that many conditions among adults are not recognized as allergic. The patients are not typical sneezers. They have stuffy noses and hyperplastic changes in the ethmoid; some have polyposis.

In many such cases, one finds that controlling the allergy first produces such marked improvement that conservative radical surgical treatment can be used instead of the more radical types.

DR. JOHN F. BARNHILL, Miami Beach, Fla.: A great deal has been said about allergy. I am coming to the conclusion that allergy is secondary and that many of the conditions that are being treated are secondary. I am somewhat of the opinion that one must look to the physiologist as well as to the general physician and the surgeon before one will be able to cure all one's patients. There are certain patients with sinal disease that will get well of themselves. There are certain patients that almost any rhinologist can cure. I am convinced that there are a large number that nobody will ever cure. There are physiologic, pathologic and anatomic reasons for this.

ATRESIA OF THE EXTERNAL AUDITORY MEATUS

CANALIZATION BY ELECTROCOAGULATION

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WASHINGTON, D. C.

Atresia of the external auditory meatus is by no means uncommon. Unfortunately, in some cases it remains unrecognized, while others fail to find their way into the literature.

On the basis of the etiologic factors, atresia is grossly classified as congenital or acquired. The abnormal embryologic events responsible for congenital atresia have been discussed in detail in the splendid work of Lyman Richards.

According to Richards,[1] the outer ear develops in a peculiar manner. It begins as a pitlike indentation of the external cutaneous surface in the region of the future auricle. The pit extends inward for a short distance in the direction of the first gill cleft. From its inner end a solid cord of ectoderm extends inward and becomes expanded medially into a disklike plate, lying on an oblique plane just outside the cavity of the middle ear. The next process is canalization from within outward of the disk, which splits into two layers, tympanic and meatal, the former lying against the ectodermal wall of the middle ear and separated from the latter by a thin layer of mesoderm. This forms the future drum membrane. Canalization continues outward until the intervening cord of ectoderm hollows into a tube and becomes continuous with the pitlike invagination. Deviation from the normal embryologic sequence of events will result in incomplete canalization and atresia of the canal.

Acquired atresia, on the other hand, may result from any of a number of causes, such as chronic purulent otitis media, otitis externa, chronic eczema, trauma to the canal, exostosis and new growths. This type of atresia is probably more prevalent and less complicated than the congenital form.

Diagnosis of atresia of the external auditory meatus is often difficult and is dependent on the location of the obstruction. When the obstruc-

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From the Department of Otolaryngology, George Washington University Medical School.

Read before the Section of Ophthalmology and Otolaryngology of the District of Columbia Medical Society, April 21, 1939.

1. Richards, L.: Congenital Atresia of the External Auditory Meatus, Ann. Otol., Rhin. & Laryng. **42**:692 (Sept.) 1933.

tion is in the cartilaginous portion of the canal diagnosis is comparatively easy. The closer the obstruction is to the external end of the canal, the shorter is the canal as compared with that on the good side, and the easier is the diagnosis.

If the obstruction, on the other hand, is in the osseous portion of the canal, diagnosis is extremely difficult. The closer the obstruction is to the normal position of the drum, the more difficult is the diagnosis. In such cases one often mistakes the obstruction for the normal tympanic membrane. These points are well brought out in the following case.

REPORT OF A CASE

L. S., a white man aged 37, consulted me on Sept. 30, 1938, at which time he complained of sharp pain and marked deafness in the left ear. This attack came on a few hours before I saw him and was similar to several other attacks he had had in the past twenty years. According to the history, the patient first complained of difficulty in the left ear in 1919, at which time simple irrigation afforded relief. In 1925, while a student at Boston, he had a similar experience with his ear and consulted the otologist at the Massachusetts General Hospital. Again simple irrigation of the ear was successful in allaying the symptoms. In 1930, while he was taking a shower, some water entered his left ear and caused him severe pain and deafness. He consulted a local otologist and obtained relief after the wax was washed out of the ear. In June, 1938, he experienced marked stuffiness in the left ear and consulted another otologist. He was told that he had a perforation in the drum and that treatment would be directed toward closing it. This time the treatment seemed to be of no avail. Subsequently, another otologist advised him of infection in that ear and prescribed antiseptic ear drops. This treatment also failed to bring about a satisfactory result, and one month later he had the attack during which I first saw him. Prior to the onset of these attacks he had at no time had any trouble with the ear, though the hearing in it was always muffled.

Physical examination revealed the following data: The throat was normal. There was a moderate deflection in the lower portion of the septum posteriorly. The right ear was perfectly normal. The left canal seemed to be shorter, greater in diameter and straighter than the right. In its course inward it tapered off and terminated in a concave wall, fleshy in appearance, devoid of landmarks and marginal definement and not sensitive to touch.

There was no isthmus or angulation in the canal, and this made it possible to view it entire, as well as the wall at its inner end, without pulling the auricle upward and backward. Measuring the length of the two canals, I found the left to be 1.5 cm. shorter than the right. The appearance of the wall left me puzzled, and I could not decide at the time whether it was a true tympanic membrane at the inner end of the canal.

I then proceeded to clean out of the canal a certain amount of epithelial debris mixed with wax. In the midst of this manipulation the patient exclaimed that his pain was gone and that the hearing had returned. Further examination revealed a tiny opening in the upper posterior quadrant of the supposed drum. Passing a blunt probe through this perforation I came on another cavity directed medially and with an axis forming an obtuse angle with that of the canal external to the membrane. The probe was stopped in its course inward by a membranous

obstruction which was sensitive to touch. Closing the perforation with a piece of thin rubber tissue, I found that the deafness and discomfort returned. At this time I decided that the first wall was a membranous stricture and not a true tympanic membrane. To corroborate my diagnosis I had roentgenograms made of both canals after plugging them with cotton soaked in iodized poppyseed oil. They readily demonstrated the differences in shape and length of the canals.

Further examination revealed that the eustachian tube on the affected side was patent and that the hearing of the left ear, though less than that of the right, was fairly good. In the words of the patient, "the hearing was back but muffled."

I informed the patient of my diagnosis and advised him that I would enlarge the existing perforation by removing the fleshy wall. He consented to this but refused to have it done by excision of the membrane. I then decided to burn away the membrane with electrocoagulation. With each treatment the opening became larger and the hearing noticeably better. Treatment was stopped when the hearing on the left side was equal to that on the right. At this time enough of the membrane was burned away, and it was possible to view the canal beyond it.

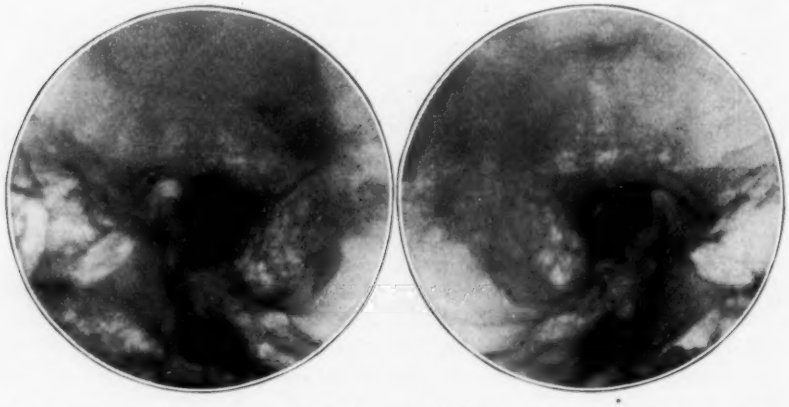

Fig. 1.—Lateral roentgenologic views of both mastoids with cotton soaked in iodized poppyseed oil plugging both external canals. This demonstrates the absence of infection in the mastoids.

It was normal in direction, and at the end of it I could see part of a dull gray membrane, which I assumed to be the normal tympanic membrane.

At the completion of treatment roentgenograms were again made of the canals after they had been plugged with iodized poppyseed oil on cotton. At this time, as is seen on the plates, the cotton in the left ear went beyond the obstruction, showing the length of the affected canal to be equal to that of the good side.

This case is of interest because of the following facts: (1) the ease with which the obstruction can be mistaken for the true tympanic membrane; (2) the difficulty in determining the classification of the condition; (3) the importance of a complete history, in which, as was true in this case, one often finds a clue to the correct diagnosis, and (4) the possibility of remedying the condition by means other than the knife.

Diagnosis in this case was difficult because the obstruction was in the osseous portion of the canal. Adam Politzer[2] spoke of such difficulty thirty-five years ago and stated that when the obstruction is close to the drum one must take cognizance of the following points: (1) definement of the margins of growth, (2) the absence of the short process of the malleus and (3) the shorter distance between the deeper parts and the external auditory orifice on the affected side than on the good side.

The classification of this deformity as to type was rather difficult. My first impression was that I was dealing with congenital atresia. But the absence of a coexisting malformation in any of the other parts

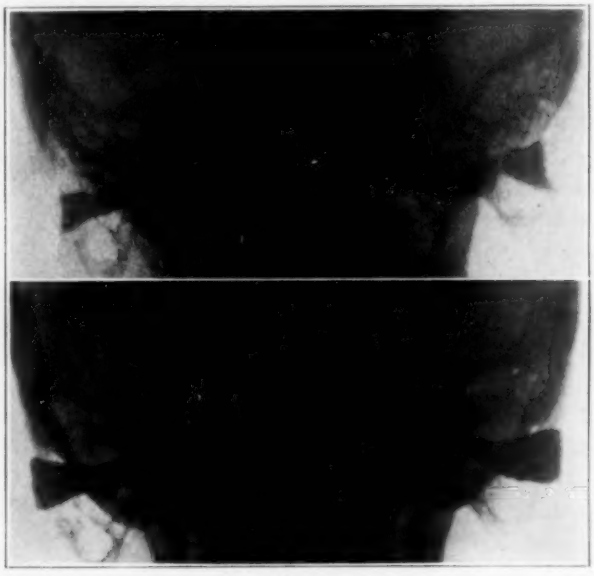

Fig. 2.—Above, anteroposterior view of the mastoids; the dark areas demonstrate the extent of the canal on each side; the left canal is much shorter than the right; the canals are filled with cotton soaked in iodized poppyseed oil. Below, the same after the left external auditory meatus was recanalized by means of electrocoagulation; the canals seem to be of the same length.

of the ear deterred me from this opinion. On the other hand, there seem to be no definite etiologic factors for acquired atresia.

Consequently, I thought it best to canvass the opinions of some nationally known otolaryngologists, and I am quoting from their communications.

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2. Politzer, A.: A Text-Book of the Diseases of the Ear, ed. 4, translated and edited by M. J. Ballin and C. L. Heller, London, Baillière, Tindall & Cox, 1902, p. 216.

Harold Hays:[3]

My own feeling in the matter is that the atresia resulted from some inflammatory process in the auditory canal, of which the patient might have been unaware.

George M. Coates:[4]

I have once or twice, I think, seen what appeared to be cicatricial closures of the canal external to the drum, but not for a long while. I do not know what the cause of them is. It is possible that they might be congenital, but I suspect that some trauma may have been responsible. I really do not know.

Lyman Richards:[5]

To me the best explanation of this problem seems to be congenital atresia of the left canal with periodic occlusion of the isthmus by cerumen and epithelial debris. I should say that the method of treatment was most commendable and ingenious.

Three other otologists to whom I have written have, at the time of writing, failed to render an opinion in the case.

The treatment of atresia of the external auditory canal advised by all authorities is surgical removal of the obstruction followed by implantation of a Thiersch graft. Unless the membranous septum is unusually thin, the procedure is fraught with difficulties because of the limited space to work in and the profuse bleeding encountered. Electrocoagulation, on the other hand, is, in my estimation, a much cleaner and easier method. Complete anesthesia in the obstructed area was difficult to obtain. I applied a 10 per cent solution of cocaine hydrochloride topically without good results. The patient, however, did not seem to experience much pain or burning sensation when the current was applied, and I was able to recanalize the ear without any difficulty.

In conclusion, I wish to stress the following points: (1) the difficulty in determining the classification of the condition, (2) the ease with which such a deformity can be overlooked, (3) the importance of taking a thorough and detailed history and carefully analyzing it and (4) the feasibility of substituting the electrocoagulation needle for the knife in the surgical treatment of such a deformity.

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3. Hays, H.: Personal communication to the author, May 4, 1939.
4. Coates, G. M.: Personal communication to the author, May 5, 1939.
5. Richards, L.: Personal communication to the author, May 8, 1939.

SHORT WAVE DIATHERMY IN TREATMENT OF NASAL SINUSITIS

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With the introduction of diathermy as a new and more effective thermotherapeutic agent as compared with the then available methods of conveying external heat to the body, efforts were made to apply this agent in the management of nasal sinusitis. The results have not been such as to encourage its general use in rhinologic practice. For reasons to be set forth, the advent of short wave diathermy gave an impetus to renewed experimental and clinical research with a view to obtaining favorable effects on certain inflammatory processes. The results of this research have brought about the present tendency to include the newer agent alone or as an adjunct to other measures in the management of inflammatory processes of the accessory nasal cavities.

Actual and alleged differences between the older, or conventional, type of diathermy and the later types of short wave diathermy necessitate a brief reference as a common basis for discussion of the clinical aspects under consideration.

The entire problem has been tersely disposed of by the Council on Physical Therapy of the American Medical Association [1] in these words:

> Medical diathermy is the therapeutic use of heat generated in the body tissues by a high frequency current which has insufficient local intensity to produce temperatures high enough to destroy the tissues or impair their vitality. Such currents are applied locally by three methods: (1) conventional long wave diathermy, contact metal electrodes being used, (2) short wave diathermy with an electric field, air-spaced or insulated electrodes being used, and (3) short wave diathermy with an electromagnetic field method, a cable being used.
>
> In conventional or long wave diathermy the frequency of oscillation is usually from one-half to three million cycles per second. In short wave diathermy the frequency of oscillations may be from ten million to 100 million cycles a second.

Claims have been advanced by certain authors that short wave diathermy is an entirely new and distinct method of therapy because, apart from its acknowledged ability to produce heat in depth, it possesses peculiar physiologic and biologic properties affecting cellular life, an assertion not devoid of a certain element of mysteriousness. This phase

1. Medical Diathermy, report of the Council on Physical Therapy, J. A. M. A. **112**:2046 (May 20) 1939.

of the problem is disposed of by the Council in the statement: "In the light of present observations, the concensus seems to be that no physiologic effects other than those attributable to heat have been substantiated," a statement with which I am in full accord.

There is, however, no question that a difference between the two types of diathermy mentioned does exist. This difference, to which I shall refer later in greater detail, consists essentially in the fact that short wave diathermy easily overcomes the ohmic resistance offered to the ordinary diathermic current by osseous structures and therefore is capable of creating heat in bones, a factor which at once suggests new therapeutic possibilities in regions of the human body containing bony structures, and therefore in the management of nasal sinusitis.

RATIONALE OF HEAT THERAPY

It was Bier [2] who first pointed out the role of inflammation as a natural reaction in repair of disease processes. Diseased accessory nasal sinuses do not differ pathologically from other organs with infectious processes, so that a remedy effective in one part of the body should prove equally beneficial in an analogous situation elsewhere. The employment of heat for its localized, hyperemic effect is not new, having been the mainstay of pioneer workers in electrotherapy. The most effective method of inducing heat on the surface of or in the body has been the chief objective of modern investigators [3] and has led to the introduction of improved sources of heat energy for this purpose.

The analgesic effect of local heat is well recognized. It is also known that local heat irradiation increases local tissue metabolism, permitting a more rapid defensive response to disease. With increased vitality of the tissues, resorptive powers enable resolution to take place more readily, unless hindered by intervening forces.

The evolution of artificial heating sources has involved a large number of objects and appliances, the difference in most of them being one of technical convenience rather than of therapeutic superiority. The signal difference is not so much in the manner of production of heat as in the fact that by diathermy heat may be produced at levels considerably below that of the subcutis. As has been mentioned, the main advantage obtained from short wave diathermy is the indisputable fact

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2. Bier, A.: Hyperemia as a Curative Remedy, ed. 2, Leipzig, F. C. W. Vogel, 1905.

3. Hollender, A. R., and Cottle, M. H.: Diathermic Studies on the Eye and Ear, Arch. Otolaryng. **3**:438 (May) 1926. Moncrieff, W. F.; Coulter, J. S., and Holmquest, H. J.: Experimental Studies in Diathermy Applied to the Eye and Orbit, Am. J. Ophth. **16**:193 (March) 1932.

that it creates heat at much greater depths than was possible with conventional diathermy, and that bony structures which present an almost insurmountable obstacle to the penetration of the longer waves are easily passed through by the short waves. Considering the osseous structure of the head and face, it is evident that the treatment of sinusitis has been rendered more effective by the added use of short wave diathermy.[4]

Aside from the hyperemic action, deep heat stimulates the flow of lymph and, if continued for a length of time, produces edema. Analgesia may be attributed to these phenomena, since they control infection through the very increase of the inflammatory process. Accordingly, the concept is justified that inflammation is a natural defensive reaction which should be augmented within certain limits rather than suppressed, and that the therapeutic value of heat is ascribable to hyperemia and hyperlymphia.[5]

INDICATIONS AND LIMITATIONS

While all that has been said applies at least in part to heat from any source, that produced by the high frequency current creates the phenomena at greater intensity. To this should be added that with conventional diathermy one hesitated to risk its application in cases of acute suppurative processes without drainage first having been established. Experience has shown that this limitation does not obtain with short wave diathermy. While this method can be safely applied to empyemic conditions of any of the sinuses, claims of European workers[6] that surgical intervention is obviated have not been substantiated.

Short wave diathermy is not a panacea, and only in a few instances has it produced favorable results without the additional use of other measures. The tendency to employ diathermy alone in the treatment of nasal sinusitis is objectionable. Furthermore, its use without an exact diagnosis having been made, as is often the case with certain practitioners, is likely to place this valuable agent in the category of unscientific procedures. When a pathologic process is such that it obviously can be eradicated only by operation, precious time will be lost in seeking to obtain relief from nonsurgical therapy.

The proper selection of cases is one of the primary requisites for the scientific utilization of short wave diathermy as a therapeutic adjuvant. It is essential to differentiate the various types of sinus disease, and for this purpose every clinical and laboratory means should be resorted to in order to assure a correct diagnosis.

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4. Kobak, D.: Radiathermy in Medicine, Arch. Phys. Therapy **16**:5 (Jan.) 1935.

5. Hollender, A. R.: Clinical Evaluation of Short-Wave Diathermy in Otolaryngology, Eye, Ear, Nose & Throat Monthly **16**:410 (Jan.) 1938.

6. Schliephake, E.: The Importance of Ultra-High Frequency Therapy, Arch. Phys. Therapy **14**:389 (July) 1933.

In spite of what has been said regarding the applicability of short wave diathermy to acute suppurative processes, drainage should be established in every case at the proper time. This is rightly emphasized in the report [1] of the Council on Physical Therapy, which states:

> Infra-red irradiation and medical diathermy are useful adjuncts to other treatment after adequate drainage has been established. Medical diathermy is of value as an aid in the relief of pain; the frontal and maxillary sinuses are the ones most suitable for treatment.

REVIEW OF PROGRESS

Several workers have investigated the value of short wave diathermy in the treatment of nasal sinusitis. In most instances local tissue temperature was not appreciably elevated, or was elevated only slightly. Tebbutt [7] expressed the opinion that topical heat is of definite value despite the drop in temperature in the sinuses, explaining, however, that this phenomenon is apparently a part of the mechanism involved in the regulation of the temperature of the body. In an effort to reconcile the favorable clinical effects with the experimental findings, Andreen and Osborne [8] conjectured:

> The benefit received from such methods is due in part to an increased circulation leading to an active hyperemia rather than any change in temperature.

Bierman [9] expressed the belief that heat is definitely of value in the treatment of sinus disease. He and his co-workers observed marked relief from pain after the application of short wave diathermy. Many of his patients had been under treatment by specialists for years. Talia [10] reported satisfactory results from the treatment of chronic sinusitis by short waves. According to him, the patients who do not respond favorably to this treatment do not improve under any form of medical treatment and therefore should be subjected to operative therapy.

CLINICAL STUDIES

With a view to evaluating correctly short wave diathermy in treatment of disease of the nasal sinuses, I repeated the temperature studies of Andreen and Osborne [8] and of Rosenwasser and Bierman.[11] In

7. Tebbutt, H. K.: Effect of Physical Agents on the Temperature of the Nasal Sinuses, Arch. Otolaryng. **22**:733 (Dec.) 1935.

8. Andreen, M. A., and Osborne, S. L.: Measurements of the Temperature of the Maxillary Sinus After Treatment by Various Methods of Heating: A Comparative Study, Arch. Otolaryng. **24**:331 (Sept.) 1936.

9. Bierman, W.: Short-Wave Currents, Arch. Phys. Therapy **18**:79 (Feb.) 1937.

10. Talia, F.: La marconiterapia nelle sinusiti croniche, Arch. di radiol. **13**:23 (Jan.-April) 1937; abstracted, J. A. M. A. **109**:1408 (Oct. 23) 1937.

11. Rosenwasser, H., and Bierman, W.: Effect of the Short-Wave Current on the Temperature of the Paranasal Sinuses, Arch. Otolaryng. **25**:555 (May) 1937.

20 selected cases of acute exacerbation of maxillary sinusitis, in which the taking of temperatures through a window was feasible, the following results were given: In 10, there was an elevation of temperature ranging from 0.6 to 1.5 F.; in 4 there was no gain or loss, and in the remaining 6 there were losses ranging from 0.4 to 1 F. No analgesic was applied intranasally previous to the experiments, because earlier work had shown that cocaine and other anesthetics influence the results. The treatments were given with air-spaced electrodes over the affected antrum for periods of fifteen minutes, and in all cases the same apparatus was employed.

In a second series of 18 cases of acute maxillary sinusitis, short wave diathermy (from a 6 meter apparatus) was applied without resort to any other therapy. In a control group orthodox procedures were employed without short wave diathermy, and in a third group short wave treatment was added to accepted routine measures. In the first group, after four days, 6 of the patients had to be given relief by irrigation, shrinkage and suction. The most favorable response was obtained in the third group, in which short wave therapy was combined with routine treatment of the sinuses. The most unfavorable result was noted in the group treated by short waves alone. In judging results, factors such as pain, tenderness, character of discharge, facility of drainage, constitutional symptoms and results of transillumination were taken into consideration. When it was believed that treatment had been completed, as determined by the factors mentioned, roentgenograms were made and compared with the original. Sufficient time was permitted to pass before a result was considered as final.

In a third series of 14 selected cases of chronic maxillary sinusitis (inflammatory and suppurative, but not definitely hyperplastic), in which the patients had previously been subjected to numerous nonsurgical methods of treatment over periods varying from one to five years, diathermy was tried to evaluate its effectiveness. Seven patients were treated with diathermy alone, and 7 had the benefit also of intranasal and constitutional remedies. Of the 7 who had short wave diathermy alone, only 1 showed moderate improvement; in the other group of 7, 2 showed a decided favorable change, and in only 1 was the improvement slight. These two groups of patients were treated over a period of one year, with an intermission after each course of fifteen applications. During the latter part of the trials the periods of treatment were extended to twenty minutes, but these had to be reduced because they produced temporary discomfort. In the earlier courses treatments were given daily; subsequent courses consisted of applications on alternate days. Here, as in the experiment with the acute conditions previously described, the same factors were used to judge possible clinical changes.

COMMENT

These studies demonstrate three important facts in connection with the use of short wave diathermy in treatment of acute and chronic nasal sinusitis.

1. Short wave diathermy is not in itself sufficiently effective in treatment of acute sinusitis to be employed to the exclusion of other recognized therapeutic procedures.

2. Short wave diathermy is not a curative method of treatment of chronic sinusitis, when used either alone or in combination with other nonsurgical measures.

3. Short wave diathermy is an effective aid to indicated accepted procedures in cases of acute sinusitis, hastening the abatement of symptoms and shortening the course of the disease.

From these observations it is evident that claims of other workers in uncontrolled cases cannot be accepted as accurate. Furthermore, there is an element of danger in the treatment of acute nasal sinusitis when short wave diathermy, or any other single procedure, is employed without regard for immediate improvement of intranasal and sinal ventilation and drainage. It seems futile to employ short wave diathermy in cases of chronic sinus disease which has persisted over long periods in spite of other intensive methods of therapy.

SUMMARY

1. The introduction of short wave diathermy has led to a more general utilization of heat therapy in the management of inflammatory processes.

2. Local deep heating of the anatomic areas in which the sinuses are situated produces analgesia through hyperemia and hyperlymphia, improves tissue metabolism, increases resorption and consequently brings about a more rapid defensive response to infection.

3. Proper selection of cases is one of the primary prerequisites for the scientific utilization of short wave diathermy as a therapeutic agent in cases of nasal sinusitis.

4. Experiments reveal that local tissue temperature is not appreciably elevated, or is elevated only slightly, a fact which is not altogether reconcilable with clinical results, especially in cases of acute sinusitis.

5. Short wave diathermy is not in itself sufficiently effective as a therapeutic agent in acute sinusitis and may occasionally lead to serious consequences when conventional treatment is omitted.

6. Short wave diathermy is an effective therapeutic aid to other procedures in cases of acute maxillary sinusitis, but is practically valueless in the large majority of cases of chronic disease of the maxillary sinus.

TREATMENT OF ACUTE SUPPURATIVE OTITIS MEDIA

DOES DOUCHING OF THE EAR SPREAD INFECTION TO THE MASTOID CELLS?

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PHILADELPHIA

This discussion presupposes a diagnosis of acute suppurative otitis media and a patient presented with a discharging ear from either spontaneous rupture or incision of the tympanic membrane.

The objects to be attained by treatment in addition to symptomatic relief include, as outlined by Macfarlan [1] in 1931, (1) bacteriologic determination of the type of infection, (2) removal of local or general causes of reinfection, (3) securing and maintaining of good drainage, (4) aseptic cleansing, (5) termination of the discharge and (6) restoration of hearing. These objectives are still excellent guides to treatment.

BACTERIOLOGIC DETERMINATION OF THE TYPE OF INFECTION

The bacteriologic determination of the type of infection is more important today than in 1931 for two reasons: First, it leads the physician to a knowledge of what is to be expected during the course of the two gross types—those caused by the streptococcus and those caused by the staphylococcus. This knowledge is extremely helpful in the outlining of treatment, particularly in the event that the suppurative otitis media is complicated by acute mastoiditis. The pathologic picture and further complications are not alike, and the two types demand different treatment. Second, it is well known that sulfanilamide is most useful in the treatment of otitic infections due to beta hemolytic streptococci and to certain of the pneumococci. While it seems feasible that it might prove effective against all organisms producing an exotoxin, the knowledge that one's patient has an infection due to a hemolytic streptococcus or the pneumococcus type III demands treatment with sulfanilamide or one of its related compounds.

Read at the monthly staff meeting of the Hospital of the Protestant Episcopal Church, Philadelphia, April 27, 1938, and at a regular meeting of the Bucks County Medical Society, June 8, 1938.

From the department of otolaryngology, service B, of the Hospital of the Protestant Episcopal Church and the otorhinologic service of Dr. George M. Coates, Graduate School of Medicine, University of Pennsylvania.

1. Macfarlan, D.: Lecture to the students of the Graduate School of Medicine, University of Pennsylvania, 1931.

My experience with this drug coincides with the mounting cures reported in the literature.

Until more is known of the drug, this form of chemotherapy is an excellent adjunct to, but not a substitute for, surgical measures for otitic infections. As in most cases acute suppurative otitis media is due to the streptococcus, I believe sulfanilamide should be used from early in the course until the patient is cured or it is proved that the invading organism is of a type not destroyed by the aid of sulfanilamide.

REMOVAL OF LOCAL CAUSES OF REINFECTION

In considering the removal of local causes, it must be remembered that the eustachian tube is a part of the middle ear, that in children it is shorter and more patulous and that most infections of the middle ear are secondary to infections of the nasopharynx and sinuses.

Treatment of the middle ear should therefore include treatment of the nasopharynx, sinuses and eustachian tubes. Measures instituted to combat infection and inflammation of these parts will help in normally conveying infectious material through the eustachian tube to the pharynx. An aural discharge will continue from the external canal until it can be conveyed through the eustachian tube.

On this score, in an endeavor to secure better aeration and drainage of the nose and sinuses, I use 0.5 to 1 per cent ephedrine hydrochloride in a 0.6 per cent saline solution, 5 to 40 drops in each nostril, according to the age of the patient, alternated every two hours with the vapor of benzedrine. When drops are used, the patient is placed in the Proetz head-low position.

Inhalation of benzedrine is particularly useful in reducing the inflammation about the mouths of the eustachian tubes. Swallowing with the nostrils closed will help in starting exudates through the eustachian tubes to the pharynx.

After the acute symptoms subside, adenoids or other masses about the pharyngeal mouths of the eustachian tubes should be removed.

It has been my experience that, with careful instruction in the method of administering the nasal drops, the more thorough the treatment of the nasopharynx and sinuses, the more rapidly the appearance of tubal patency will result, and with it will come normal drainage of the ear.

Drainage, a primary requisite of treatment, will be hampered by any obstruction in the external canal. This may include inspissated pus, epithelial scales, wads of macerated skin flakes or closure of the external meatus, secondary to complicating diffuse external otitis.

MAINTAINING DRAINAGE

As to maintaining free drainage and aseptic cleansing, considerable partisan argument has arisen at times regarding the merits of the

so-called "dry" and "wet" methods of treatment in cleansing an acutely suppurating middle ear. Some otologists have suspected that irrigation or douching of the ear for acute otitis media spreads infection to the mastoid cells.

Of course, all are aware that there is a class of fulminating conditions in the presence of which the mastoid cells and middle ear become involved simultaneously. Mastoiditis in these instances is not due to the retention of pus within the tympanic cavity, to its obstruction in the external meatus or to the after-treatment. Consequently, one cannot expect to obviate the mastoiditis by any manner of otologic treatment to maintain drainage, since the etiologic factor is not interference with adequate drainage.

The dry treatment, on the other hand, presupposes personal attention by the physician at such frequent intervals that for practical purposes in dispensary and most private practices it is rarely available in the average case.

To determine whether irrigation solutions enter mastoid air spaces, Shapiro,[2] in 1933, irrigated the ear with a 1 per cent solution of methylthionine chloride (methylene blue) one hour prior to mastoid operation. In 5 cases no trace of the dye was discovered in the mastoid cavity.

In an experiment on 2 cadavers he completely removed the tympanic membranes and similarly injected the dye. He allowed the fluid to remain in the external canal and middle ear of the first cadaver. It was found in the cells at mastoidectomy. He stated the belief that the solution penetrated the mastoid cells as soon as the cortex was opened permitting the escape of air.

In the experiment on the second cadaver he followed the same technic but used more force and dried the canal before opening the cortex. The dye was found staining the throat as it had passed through the eustachian tube. The mastoid cells, however, were free from dye.

He concluded from his experiments that when solutions are injected into the middle ear they cover the only outlet for the air, the aditus ad antrum, and, since the air cannot escape, the solution cannot enter.

I believe this conclusion to be erroneous. It was found possible to fill a bottle having a ⅛ inch (0.32 cm.) mouth with solution by a continuous stream directed against the mouth. As air bubbled out, due to the pressure of the stream, the solution dropped into the bottle either in the upright or in the horizontal position. Similarly, a solution passed by stream through the external meatus could reach the mastoid cells.

It has been my experience that most advocates of the so-called "wet method" of treating acute otitis do not irrigate the ears with a large

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2. Shapiro, D.: Irrigation of the Ear in Acute Otitis Media, Arch. Otolaryng. **17**:384 (March) 1933.

amount of solution from an irrigating can but advise the use of the 1 ounce (30 cc.) pear-shaped rubber bulb with a soft, tapered end.

The attendant is instructed to direct the stream along the meatal walls and not against the drum membrane. Pain and vertigo follow carelessness in this regard. To permit better flow of the solution, the canals in adults are straightened by pulling the auricle up and back, and in children, down and back. Straightening the canal also prevents retained solution, internal to the isthmus, from macerating its walls. The canal is thus douched until the return flow is clear. Four or 5 ounces (120 to 150 cc.) of solution is usually sufficient. The canal is then dried by first blowing air into it with the rubber bulb and then applying long, firmly rolled, cylindric cotton pledgets.

To simulate their technic more closely, in 1935 and 1936 I douched the ears of 10 patients with acute mastoiditis and 3 with chronic mastoiditis with a 1 per cent solution of methylthionine chloride (methylene blue) immediately before mastoidectomy.

One patient with a chronic condition had a large perforation of the tympanic membrane, and 2 had acute exacerbation of a chronic infection with a small perforation. Of the 10 patients with an acute condition, 4 had had previous myringotomy; 5 had had spontaneous rupture of the tympanic membrane before being brought to the clinic, and 1 had had myringotomy performed despite spontaneous rupture. The ears were not dried of the solution before operation, and no trace of the dye was found in the presence of an acute condition or of a chronic condition with a small perforation of the tympanic membrane. It was found, however, in the antral cell of the patient with a chronic condition and a large perforation of the drum membrane.

In addition to using this technic at operation I performed similar experiments on 3 cadaver ears. The tympanic membrane of 1 was incised. The drum membranes of the others were absent. The canals and middle ears were thoroughly dried before mastoidectomy. Methylthionine chloride (methylene blue) solution was found in the 3 mastoid processes.

With this experience and that of the dye being found at operation on the patient who had chronic mastoiditis with a large perforation of the tympanic membrane, I am compelled to differ with Shapiro and state that it *is* possible to carry infection from the external canal to the mastoid cells in the presence of a chronic condition with a large perforation. This is probably one of the reasons why some patients with chronic suppurative otitis media are not cured by the douching treatment of their ears.

I agree with Shapiro and have proved to my satisfaction that it is not possible to carry infection to the mastoid cells in the presence of an acute condition.

I believe that it is the acute swelling of the mucosa, the relatively small perforation and the high position of the aditus ad antrum in relation to the line of incision of the myringotomy or the spontaneous perforation which prevent douching solutions from entering the mastoid cells in the presence of an acute condition.

ASEPTIC CLEANSING

As to aseptic cleansing, those who uphold the value of douching or irrigations have used various solutions, including solution of formaldehyde, chlorine, the dyes, alcohol, mercury bichloride, boric acid and physiologic solution of sodium chloride. Solutions of alcohol and of formaldehyde cause a considerable burning sensation following their use in the presence of an acute condition and therefore are not widely used. Weak alcoholic solutions are not bactericidal. Solutions of chloride and of mercury bichloride are not generally used because of the increased likelihood of maceration of the meatal skin. So, by heritage and empiricism, otologists have had given to them the almost universal use of boric acid solution. This solution is only weakly bacteriostatic and definitely nongermicidal.

The newer, nonirritating salts of mercury have been reported definitely germicidal by Schamberg, Kolmer and Raiziss [3] and 100 per cent effective for antisepsis of the skin by Birkhaug.[4] They are nonirritating to the skin in proper dilution. They are compatible with 95 per cent alcohol. One of them, the anhydride of 4, nitro-5-hydroxymercuriorthocresol (metaphen), containing about 56 per cent mercury, was selected for use. When used every two or three hours in a 1 to 10,000 dilution, it was found not to macerate or irritate the skin in acute cases.

The proneness of the meatal skin to fissures, furuncles and acute diffuse external otitis is well known. In a majority of the cases observed acute suppurative otitis media is complicated by external otitis as a result of the irritating discharge. Gleason [5] made the following statement:

> Diffuse inflammation of the [external] auditory canal varies in character from a simple erythema of the skin . . . to severe periostitis [of the canal]. The disease [is] usually . . . [limited to] the osseous portion of the canal, but it may extend to the auricle, and, by periosteal continuity, to the periauricular and mastoid regions, causing abscess and necrosis.

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3. Schamberg, J.; Kolmer, J., and Raiziss, G.: A New and Superior Mercurial Germicide, J. A. M. A. **68**:1458 (May 19) 1917.

4. Birkhaug, K. E.: Metaphen (4-Nitro-3, 5-Bisacetoxy-Mercuri-2-Cresol): A Comparative Study of Commonly Used Disinfectants and Antiseptics, J. A. M. A. **95**:917 (Sept. 27) 1930.

5. Gleason, E. B.: A Manual of Diseases of the Nose, Throat and Ear, ed. 2, Philadelphia, W. B. Saunders Company, 1910, p. 337.

The last-named condition is often difficult to differentiate from acute mastoiditis and certainly complicates the treatment.

I have repeatedly heard patients with simple erythema complain of severe pain when the cotton probe is passed over the area and believe that much of the pain of which patients complain while having an acute condition competently treated is due to the complicating external otitis. Therefore, measures to prevent or treat the external otitis should be included in the treatment of the suppurating middle ear. This can be accomplished by douching the discharges from the external canal by a germicidal solution and applying a bland antiseptic ointment to the meatal walls.

After the acute condition has subsided, usually in seven to fourteen days, alcohol is added to the mercurial germicide because of its astringent effect on the mucosa. I start with 35 to 40 per cent alcohol, gradually increasing the strength of the alcohol to 95 per cent. Later in the course of the infection, as the higher percentage of alcohol is reached, some patients complain of its burning sensation. This can be obviated by instilling 5 drops of a 2 per cent solution of pontocaine hydrochloride five minutes before the douche. Schmidt [6] stated:

> [The astringent action of alcohol] gives the exudate a better outlet through the wider hole in the tympanic membrane. . . .
>
> When . . . the hole in the tympanic membrane is widened by the shrinkage and the Eustachian tube is opened for outflow of the exudate, and the greatly thickened mucous membrane of the middle ear has shrunk through the astringent effect of the alcohol, . . . the best conditions [have been produced] for . . . ventilation [and drainage] of the mastoid cells. . . .

Macfarlan [7] concluded:

> There is no excuse to allow the . . . ear to discharge indefinitely, nor intermittently.
>
> If methods such as are here suggested, are conscientiously carried out and the discharge continues . . . [longer than eight weeks, drainage through the external auditory meatus is evidently inadequate, and a] simple mastoid operation should be done. [Possible general and local causes of prolonged discharge must first be eliminated.]
>
> All these interests are directed . . . [not only toward the prevention of further complications but] toward the preservation of hearing, the loss of which is so often irreparable.

CONCLUSIONS

1. Under ordinary circumstances, douching of an acutely suppurating middle ear will not carry infection into the mastoid cells.

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6. Schmidt, V.: Treatment of Acute Suppurative Otitis Media by Syringing with Alcohol, J. Laryng. & Otol. **50**:594 (Aug.) 1935.

7. Macfarlan, D.: Methods of Caring for the Discharging Ear, Pennsylvania M. J. **36**:29 (Oct.) 1932.

2. The mercurials of the orthocresol group, alone or with alcohol, are satisfactory douching solutions.

3. The treatment of external otitis should be included along with that of suppurating otitis media.

4. Sulfanilamide therapy can be used to advantage in the treatment of the majority of acute otitic infections.

5. Otitic suppurations, continuing eight weeks or longer, demand simple mastoidectomy as a measure directed toward the preservation of hearing.

BENIGN CYSTS AND ADAMANTINOMAS OF THE JAWS

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Cysts and cystlike lesions of the jaws are encountered frequently. Adamantinomas are relatively rare. Many of the so-called dentigerous and radicular cysts are small, but these and certain other cysts may become large. This paper deals mainly with larger cysts and with adamantinomas. It is based on a study of a series of 198 cases of benign cyst and of 58 cases of adamantinoma, approximately a third of the cases in each group having come more or less closely under my observation.

In the second month of fetal life [1] infolding of the gingival epithelium takes place to form the dental ridge. At intervals along the dental ridge epithelial buds push into the mesoderm; these become pedunculated and bulbous and are then known as "enamel organs." In the fourth month the mesoderm pushes into the deeper surface of the bulbous enamel organ, invaginating it and converting it into a bell-shaped structure (fig. 1). On the inner and outer surfaces of the bell are thin layers of flat epithelial cells, which are sometimes called the "inner and outer tunics." Those epithelial cells that fill the space between them assume a stellate form, with mucoid material in the interspaces, and comprise the stellate reticulum.

The invaginating mass of connective tissue is known as the "dental papilla." Its outer cells become specialized to produce dentin, while those of the central portion eventually become the pulp of the tooth. A single layer of epithelial cells of the inner tunic lying next to the crown portion of the dental papilla becomes specialized to produce enamel. These are the ameloblasts. The inner and outer tunics of the enamel organ over the root portion of the dental papilla become compressed to form a loop or duplication which encircles the forming root. This is known as the "sheath of Hertwig" and is thought to determine the shape of the root and to regulate the formation of dentin. During this process,

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Presented as a candidate's thesis to the American Laryngological, Rhinological and Otological Society, Inc.

1. Kronfeld, R.: (*a*) Histopathology of the Teeth and Their Surrounding Structures, Philadelphia, Lea & Febiger, 1933; (*b*) Dental Histology and Comparative Dental Anatomy, ibid., 1937.

small groups of epithelial cells become detached from it and embedded in the surrounding connective tissue. These, together with occasional persisting remnants of Hertwig's sheath or of other portions of the enamel organ, make up the epithelial "debris" of Melassez, whose theory that certain cysts and tumors of the jaws arise from this "debris" is accepted generally.

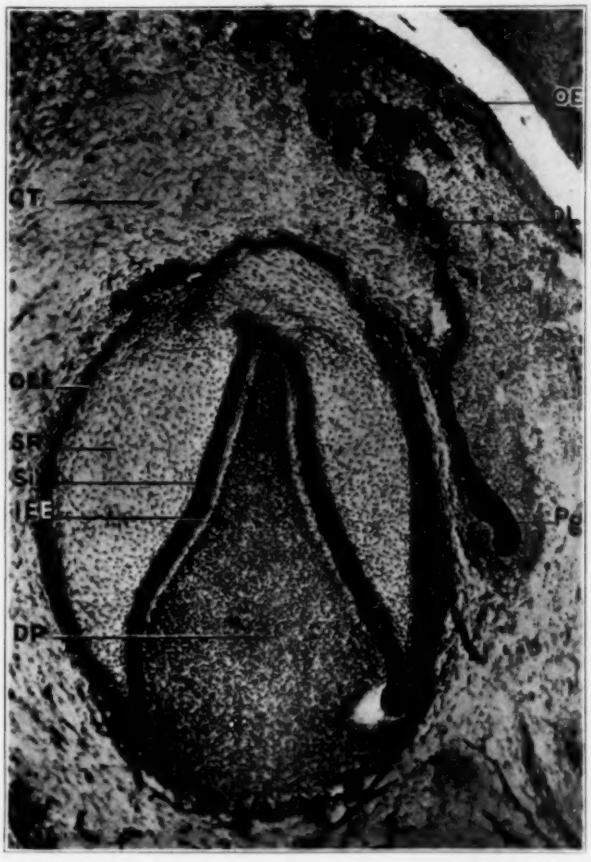

Fig. 1 (from Kronfeld,[1b] with permission of the author).—Bell-shaped enamel organ at the deciduous cuspid of a human embryo of the fifth fetal month; *OE* indicates oral epithelium; *DL*, dental lamina; *Pg*, anlage of permanent cuspid located on the lingual side of the enamel organ of the deciduous cuspid; *OEE*, outer enamel epithelium; *SR*, stellate reticulum; *Si*, stratum intermedium; *IEE*, inner enamel epithelium; *DP*, dental papilla; *CT*, connective tissue of tooth follicle. (*OEE* is referred to in the text as the "outer tunic;" *Si* plus *IEE* are together referred to as the "inner tunic.")

The term "odontoma" is used to include tumors and cysts of the jaws which originate from dental embryonic remnants. The type of tumor or cyst arising as a result of proliferation of these epithelial remnants

depends not only on the type of cells from which it originates but also on the degree of their differentiation. If a tumor of well differentiated cells originates from the remnants of the tunics or of the stellate reticulum, cystic degeneration occurs, with the formation of an epithelium-lined, mucus-filled cyst (follicular cyst). The proliferating cells may resemble those of the layer of ameloblasts and result in a solid tumor, which is usually, though not always, calcified (solid odontoma). If little or no differentiation occurs, a tumor made up of nests of embryonic cells (adamantinoma) results. The solid odontoma will not be considered in this paper except to point out that when uncalcified it may be indistinguishable roentgenographically from a cyst.

For clinical consideration of cystic odontomas and of benign cysts of the jaws of nondental origin the following outline is helpful:

1. Cystic odontomas
    (a) Follicular cysts
        (1) Those containing an associated tooth
        (2) Those not containing an associated tooth
    (b) Adamantinomas
2. Cysts of inflammatory origin
3. Cysts of traumatic origin
4. Cysts of indeterminate origin
5. Cysts developing from nondental embryonic rests
    (a) Median anterior maxillary cysts
    (b) Facial cleft cysts

In the differential diagnosis the following lesions must be borne in mind. Clinically and roentgenologically any of them may be indistinguishable from a cyst. Exploration and biopsy may be necessary to establish the true diagnosis:

1. Giant cell tumor
2. Uncalcified solid odontoma
3. Fibroma
4. Dermoid
5. Angioma
6. Hemangioendothelioma
7. Metastatic malignant tumor
8. Osteitis fibrosa cystica
9. Paget's disease
10. Fibrocystic disease
11. Sarcoma
12. Chondroma
13. Squamous cell epithelioma invading the jaw

FOLLICULAR CYSTS

Recalling that the developing tooth is surrounded by those portions of the enamel organ which normally undergo atrophy (the stellate reticulum, the outer tunic and all but the single layer of enamel-forming cells from the inner tunic), one readily sees that if a cyst forms as a result of proliferation beginning in remnants of any of these structures lying superficial to a tooth, its eruption will be interfered with and the cyst will be likely to surround the tooth more or less completely. If the process begins alongside the tooth, its eruption may continue with little or no disturbance, and the cyst may come to lie below or partially surrounding its root. With the enlargement of the cyst and resorption of the surrounding bone, it may finally come to underlie or partially surround the roots of several teeth.

In cases in which roentgenologic examination reveals a cyst containing a tooth, it can often be noted that a tooth is absent from the number normally present in that region. Occasionally, however, the full quota of teeth are present, and the tooth in the cyst proves to be an anomalous one. Rarely, a tooth is missing and a cyst is found which does not contain a tooth; in such cases one must assume that the enamel organ failed to function.

These cysts affect males and females with about equal frequency, and they are a little more likely to be found in the lower than in the upper jaw. They are discovered with equal frequency in the third, fourth, fifth and sixth decades of life, about half as frequently in the second and seventh decades and only occasionally at other ages. The youngest patient at the Mayo Clinic was a child of 20 months.

Follicular cysts may produce no symptoms and be found only on routine roentgenologic examination. When present, symptoms most often are of six months' duration or less, although some patients describe symptoms dating back as long as two years and occasionally longer. One patient at the Mayo Clinic had had trouble for thirty years. Painless swelling is the complaint most frequently noted. Painful swelling, swelling with discharge and a persistent sinus after extraction of a tooth are each noted occasionally.

The diagnosis usually can be made with reasonable assurance on roentgenologic examination. The smooth bony cavity is clearly outlined without evidence of thickening of the margins. The cyst almost always is unilocular.

Treatment consists of complete removal of the lining membrane and of one wall of the bony cavity in order to convert it into a saucer-like depression. The lining usually strips out readily. Recurrence rarely follows this method of treatment.

Some have advocated simply opening the cyst and inserting a drainage tube for a period sufficient to permit continuous epithelization between the lining of the cyst and the mucous membrane of the mouth. It has been claimed that if this is done the cavity eventually will disappear. I have had no experience with this method.

On microscopic examination follicular cysts usually are found to be lined with squamous epithelial cells. Long-continued infection may destroy the epithelial lining, in which case thick fibrous inflammatory tissue replaces it.

CYSTS OF INFLAMMATORY ORIGIN

Cysts of inflammatory origin are known as "radicular cysts" and result from infection at the tip of a pulpless tooth. They may or may not have an epithelial lining, which is believed to develop from fragments or remnants of Hertwig's sheath. If an epithelial rest lies in the wall of an abscess, the cells proliferate to provide a lining for the cavity of the abscess.

Usually these cysts are small, and often they adhere to the root when the tooth is extracted. Occasionally they become large, and unless there is an associated pulpless tooth they may be indistinguishable from follicular cysts of the type which contain no tooth.

Stafne [2] called attention to the apparent development of similar cysts around retained deciduous roots. He reported a case in which a radiopaque nodule surrounded by a cystic cavity was seen in the roentgenogram of the jaw of an elderly woman. At operation, a cyst lined with squamous epithelium and containing a deciduous root was found. There was no connection between the cyst and the roots of the adjacent permanent teeth.

CYSTS OF TRAUMATIC ORIGIN

Ivy and Curtis [3] recently gave an excellent description of cysts of traumatic origin. They are analogous to those nonepithelium-lined cysts of long bones which have been believed to result from the formation of hematomas following trauma. An injury insufficient to cause fracture may lead to hemorrhage in the medullary portion of the bone. Thoma (quoted by Ivy and Curtis [3]) believed that the decomposition of the fibrin causes an irritation which leads to resorption of the cancellous portion of the bone with the formation of a cavity.

Occasionally a cystic cavity may be found in the mandible of a child or young adult who gives a history of trauma a few weeks previously. Usually there is a moderately painful swelling of the bone at the point

2. Stafne, E. C.: Possible Rôle of Retained Deciduous Roots in the Etiology of Cysts of the Jaw, J. Am. Dent. A. **24**:1488-1493 (Sept.) 1937.

3. Ivy, R. H., and Curtis, L.: Hemorrhagic or Traumatic Cysts of the Mandible, Surg., Gynec. & Obst. **65**:640-643 (Nov.) 1937.

of injury. Roentgenologic examination reveals a cavity in the bone along the course of the inferior dental canal, with no apparent connection with the roots of the overlying teeth. It may be impossible, without exploration, to differentiate such a cavity from a cyst of dental origin, particularly if some of the overlying teeth are pulpless.

At operation, if the cavity is found to be unlined and if the contents present evidence of hemorrhage, traumatic origin of the cyst is highly probable. In more recent cysts blood may be evident grossly. Older cavities are likely to contain a straw-colored fluid, and the evidence of hemorrhage may consist only in the finding of microscopic evidence of degenerated blood and of cholesterol crystals.

Evacuation of the contents of the cavity usually is all that is necessary to bring about a cure.

CYSTS OF INDETERMINATE ORIGIN

In 4 cases in the present series a large cyst at the angle of the mandible was found to contain material like oatmeal gruel. This material was quite different from that encountered in any cysts elsewhere in the mandible. Three of these cysts had no lining and were unilocular, whereas the fourth was lined with squamous epithelium and was multilocular. The unlined cysts possibly were of traumatic origin and the multilocular epithelium-lined cyst may have originated as a follicular cyst; the explanation for the material in them, however, resembling "oatmeal gruel" remains uncertain.

There are no clinical or roentgenologic findings to differentiate these from other cysts. The findings at operation are so characteristic, however, as to justify a separate classification for the group.

The treatment need not differ from that for other benign cysts.

MEDIAN ANTERIOR MAXILLARY CYSTS

Recently, Stafne and his associates [4] published an excellent historical summary and discussion of median anterior maxillary cysts, together with reports of 3 cases. Such cysts are of nondental origin and are situated in the region of the anterior palatine canal.

Meyer reported the first cyst of this type in 1914; it was found in a cadaver while median sections were being made. Although there were occasional reports of such cysts subsequently, their frequency was not appreciated until 1931, when Meyer [5] published the results of a study of 600 cadavers. He found 1 such cyst in every 66 specimens. He also

4. Stafne, E. C.; Austin, L. T., and Gardner, B. S.: Median Anterior Maxillary Cysts, J. Am. Dent. A. **23**:801-809 (May) 1936.

5. Meyer, A. W.: Median Anterior Maxillary Cysts, J. Am. Dent. A. **18**:1851-1877 (Oct.) 1931.

stated that on examination of roentgenograms he found what he considered to be good evidence of such a cyst once in 88 instances. Stafne and his associates [4] stated that they found good roentgenographic evidence of them once in each 100 dental roentgenograms. Formerly these cysts evidently were mistaken in dental roentgenograms for anomalies or for abnormally large anterior palatine fossae.

Meyer's [5] belief that such cysts arise from epithelial remnants which persist in the nasopalatine closure appears well founded. In discussing the nasopalatine canals Schaeffer [6] wrote:

> Approximately 2 cm. dorsal to the inner margin of the nostril and in juxtaposition to the nasal septum each nasal fossa presents a slight depression in its floor. This depression leads into a small canal lined with mucosa prolonged from that which lines the inferior nasal meatus. This funnel-shaped tube of mucous membrane, the nasopalatine canal, courses obliquely caudal-ward and . . . passes through the Y-shaped incisive foramen (anterior palatine canal) in the hard palate. The canals end on the roof of the mouth at the side of the palatine papilla or incisive pad.
>
> The nasopalatine canals are remnants of the wide communication between the nasal and oral cavities found at an early period of fetal life. Occasionally in adult man they lead to a direct communication between the nasal fossa and the buccal cavity. In the majority of instances, however, the lining of the canals is obliterated and represented by impervious cords of epithelial cells continuous with the roof of the mouth at one extremity and with the funnel-shaped epithelial-lined depressions in the floor of the nasal fossae at the other.

From this excellent description of the nasopalatine canals it is easy to understand that a persistent canal or proliferation of portions of persistent epithelial cords might give rise to an epithelium-lined cyst. These cysts are found anteriorly in the middle of the upper jaw, just above or partially between the root tips of the upper central incisors. They seldom give rise to symptoms and usually are discovered in the course of routine dental roentgenographic examination. Stafne and his associates [4] gave an excellent description of the normal roentgenographic appearance of this area and of its appearance when a cyst is present. The treatment is surgical, with removal of the lining of the cyst.

On microscopic examination the lining is found to consist of squamous, transitional or columnar epithelium, according to whether the cyst arose at the buccal extremity, at the midportion or at the nasal end of the canal or epithelial cord. In the group of cases under consideration there were 4 such cysts.

FACIAL CLEFT CYSTS

In the second month of fetal life there appear on either side of the nasofrontal process two ectodermal thickenings, the medial nasal process

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6. Schaeffer, J. P.: The Nose, Paranasal Sinuses, Nasolacrimal Passageways and Olfactory Organ in Man: A Genetic, Developmental, and Anatomico-Physiological Consideration, Philadelphia, P. Blakiston's Son & Co., 1920.

and the lateral nasal process. Between the two thickenings, on either side, is a depression, the future nasal vestibule. As development progresses, the two medial processes fuse to form a single median process, which eventually forms the middle portion of the upper lip and jaw and part of the nasal septum.[7] The lateral nasal process forms the lateral wall and the ala of the nose. The fusion of the maxilla with the median and lateral processes completes the formation of the upper jaw and lip and the nose. Complete failure of closure results in harelip and cleft palate. Persistence of epithelial remnants in the line of closure undoubtedly may occur, and it is believed that these give rise to cysts in this region.

In the present series we encountered 21 cysts of this type. They are found under or just below the nasal ala. Frequently they elevate the floor of the nasal vestibule, sometimes sufficiently to interfere with breathing. They are not intraosseous but usually lie in a depression in the bone. Rarely, they are extensive, and a large cavity is found separating the maxilla from the premaxilla, sometimes extending well back along the floor of the nose, with involvement of the palate. Not infrequently a defect in the anteromesial wall of the antrum is found.

Microscopic examination of the cysts in the cases observed at the Mayo Clinic revealed a lining of squamous epithelium in 9 instances, of columnar epithelium in 3, of cuboidal epithelial cells in 1 and of fibrous inflammatory tissue in 8.

Treatment consists of removal of the lining, which usually is readily accomplished through an incision under the upper lip. Occasionally in cases in which the cyst elevates the floor of the nasal vestibule, it is impossible to separate the wall of the cyst from the skin of the floor of the nose, and a small portion of the latter must be removed. This has not been found to cause any trouble.

ADAMANTINOMAS

An adamantinoma of the jaw results when paradental embryonic epithelial remnants proliferate with little or no differentiation of the cells. McGregor[8] stated the belief that the tumor sometimes may originate from gingival epithelium. Broders and MacCarty[9] cited Buchteman and Kolaczek as stating that the adamantinoma may arise from the mucous membrane or from the mucous glands of the mouth. Broders[10] recently said that he has seen 3 specimens which support the

7. Keith, A.: Human Embryology and Morphology, ed. 5, Baltimore, William Wood & Company, 1933.

8. McGregor, L.: A Report of Eleven Instances of Adamantinoma with a Review of the Malignant Cases in the Literature, Acta radiol. **16**:254-274, 1935.

9. Broders, A. C., and MacCarty, W. C.: Epithelioma, Surg., Gynec. & Obst. **27**:141-151 (Aug.) 1918.

10. Broders, A. C.: Personal communication to the author.

view that an adamantinoma may originate from the epithelium of the gum; he does not subscribe to the idea that it may originate from mucous glands.

The adamantinoma is a malignant tumor made up of nests of cells in a stroma of normal connective tissue (fig. 2 *A*). These masses of cells resemble in varying degree the epithelial structures present in the embryonic stage of development of the normal tooth. Early, the tumor is solid, but cystic degeneration soon appears and gives it a characteristic multilocular cystic arrangement. The tumor is slow growing and inactive. Some pathologists believe it should be classified as a nonmalignant neoplasm. However, it grows uninterruptedly; it recurs persistently if incompletely removed, and it gives rise to metastasis [11] (fig. 2 *B*). All these characteristics are clinical earmarks of a malignant tumor.

The patient with an adamantinoma frequently describes only one symptom, namely, a slowly enlarging tumor of the jaw. In the series of 58 cases observed at the Mayo Clinic this was the only symptom in 39. "Tumor with pain" was recorded in 11 cases, the pain being described as "slight" except with the more advanced tumors. "Tumor and draining sinus" were recorded in 6 instances. Drainage usually had followed extraction of teeth or an operation. "Loosening of teeth and pain" were recorded as the outstanding symptoms in 1 case. The symptoms were not recorded in 1 instance.

Twenty-three of the patients were males; 35, females. Their ages by decades on admission were as follows: second decade, 1; third decade, 9; fourth decade, 16; fifth decade, 13; sixth decade, 12, and seventh decade, 7.

The duration of the disease on admission ranged from six months to twenty-nine years. In 38 instances the disease had been present from one to ten years and in 15 from eleven to twenty years. In 3 instances the history dated back more than twenty-one years. In 2 cases the duration of the disease was not known.

Adamantinomas occur most commonly in the lower molar and bicuspid regions. On the assumption that the tumor had originated at the approximate center of the area involved, in the cases in the present series, in which there was involvement of the lower jaw 26 tumors apparently originated in the molar-angle region, 21 in the bicuspid region and 5 in the incisor-cuspid region; 1, an extensive bilateral lesion, probably began in the central incisor area. The tumor originated in the right side of the upper jaw in 1 instance and in the left side of the upper jaw in 4.

11. Vorzimer, J., and Perla, D.: An Instance of Adamantinoma of the Jaw with Metastases to the Right Lung, Am. J. Path. **8**:445-454 (July) 1932.

The diagnosis of an advanced adamantinoma may be suspected from the long history of a good-sized tumor of the jaw which has not

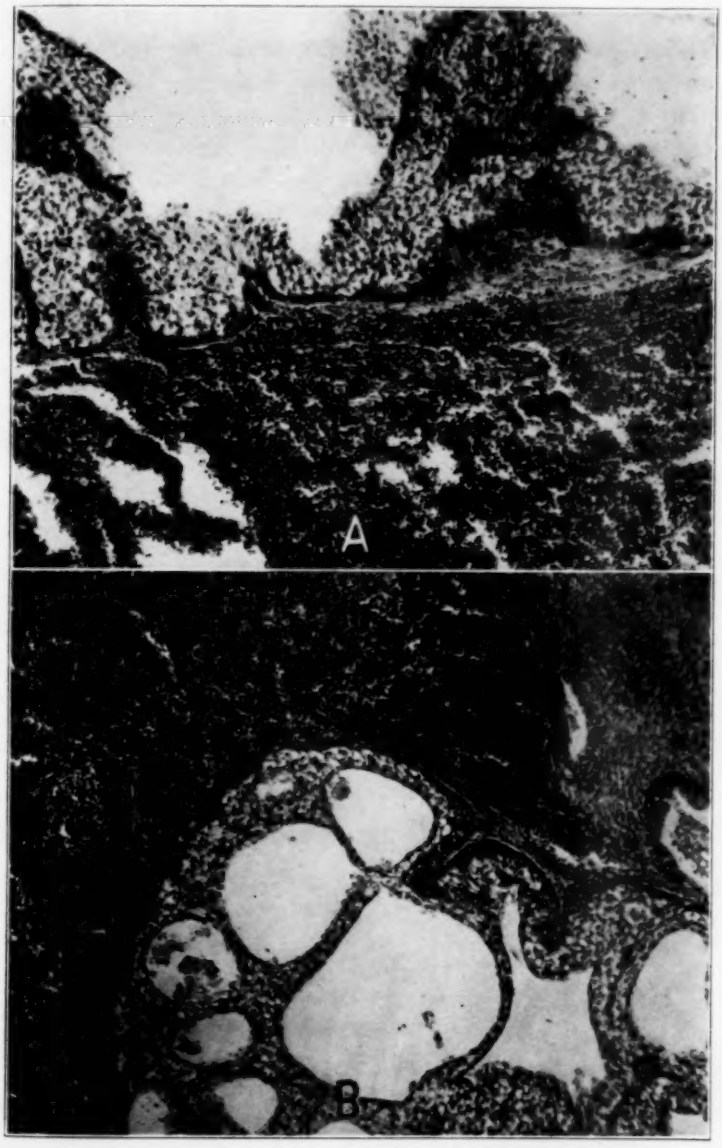

Fig. 2 (case 1).—*A*, adamantinoma of the mandible. *B*, metastatic adamantinoma in a submaxillary lymph node.

invaded the soft tissues. Sometimes a crackling sensation can be elicited on palpation of prominent portions of the tumor, and sometimes there is a history of spontaneous or surgical drainage of straw-colored

fluid. Roentgenographically, the multilocular cystic arrangement of the bony shell and trabeculae is characteristic (fig. 3 *A*). In the present series the diagnosis was confirmed by microscopic examination in 53 cases. It was made by roentgenologic examinations alone in 2 cases, by exploration alone in 2 and by clinical examination alone in 1 case, in which the condition was hopelessly advanced.

The treatment of adamantinoma, to be successful, must be surgical and must be radical. Because the growth of the tumor is slow, the temptation is to employ conservative measures, such as curettement, with or without chemical or thermal cauterization of the wound and perhaps combined with irradiation. Such methods of treatment have been widely used, and the percentage of failures has been high. This has been well shown by McFarland and Patterson,[12] who collected from the literature reports of 166 cases of adamantinoma of the jaws. In 90 of these reports, data were available regarding the progress of the patient

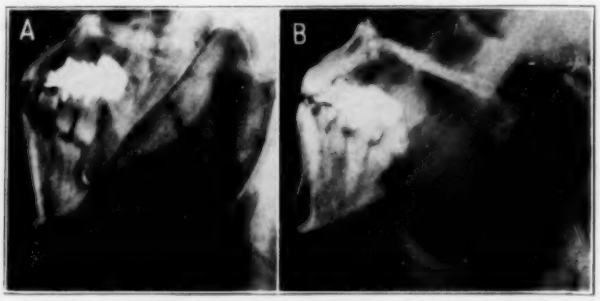

Fig. 3 (case 1).—*A*, recurring adamantinoma. Note the thinness of the remaining portion of the ascending ramus. *B*, roentgenogram taken eight months after removal of the tumor by surgical diathermy. Note the increase in thickness of the remnant of the ascending ramus.

after treatment. There were 65 cases in which a variety of conservative methods had been employed, and in this group recurrence was reported in 33, a percentage of failure of 50.7. On the other hand, in the same series there were 25 cases in which resection of the mandible had been carried out. In this group 5 recurrences were reported and 1 postoperative death, a percentage of failure of only 24.

The reason for the high percentage of failures following the conservative types of treatment can be seen readily on examination of microscopic sections which include the outer portion of a tumor together with the adjacent shell of bone. In these, microscopic finger-like extensions of the tumor into the bone can be seen. Obviously curettement or any similar measure is likely to fail to remove all of them.

12. McFarland, J., and Patterson, H. M.: Adamantinomata: A Review of One Hundred and Ninety-Six Cases Reported in the Medical and Dental Literature, Dent. Cosmos **73**:656-670 (July) 1931.

In the earlier cases observed at the Mayo Clinic the conservative type of treatment usually was employed, and the results proved disappointing. As a result, my colleagues and I have come to employ surgical diathermy or resection exclusively. Of 20 patients so treated, we have been able to trace 19. Sixteen of them (84.2 per cent) have been free from recurrence for an average of six and one-fifth years.

In the use of surgical diathermy, the entire tumor is coagulated, and the surrounding bone is cauterized sufficiently to cause a sequestrum at least 5 mm. in thickness. Tumors involving a considerable proportion of the thickness of the mandible can be removed in this way, leaving a bridge of normal bone. This bridge thickens appreciably during the two or three months required for separation of the sequestrum, and in many instances a surprisingly narrow remnant thickens sufficiently to maintain the contour and function of the jaw (fig. 3 *B*).

If resection of the mandible is necessary, diathermy is admirably suited for this also. The mandible is exposed and severed anterior to the growth. The diathermy electrode is then applied to the cut end of the bone containing the tumor, and a strong current is used to raise the temperature of the bone until the periosteum is blanched and rendered friable. The soft tissues can then be separated from the heated portion of the bone with the finger and the charred bone cut away. This process is repeated as often as necessary to remove the desired portion of the mandible together with all the expansions made by the tumor. After exposure and section of the mandible, the operation is practically bloodless, so that the extensions of tumor can be identified and removed with a high degree of certainty.

The following report of a case illustrates three important points regarding adamantinoma of the jaw: (1) the failure of conservative treatment, (2) the development of metastatic adamantinoma[13] and (3) the successful treatment of recurrence by means of surgical diathermy.

In June 1925 a married woman of 49 came for examination because of swelling of the right side of the lower jaw, which had been noted for several years and which was increasing. On examination a multilocular cystic tumor was found involving the posterior half of the body of the right side of the mandible and the lower half of the right ascending ramus. Two enlarged glands were palpable in the right submaxillary region.

13. In this series there was 1 other case in which metastasis occurred. The patient died. Another patient died elsewhere with a diagnosis of "tumor of the lung." This may have been a metastatic adamantinoma.

Since this paper was prepared I have seen an additional patient who had an adamantinoma of the jaw with metastasis of the submental and submaxillary nodes. The diagnosis was confirmed by microscopic examination of tissue both from the primary and from the metastatic nodes. There has been no recurrence after nine months.

On July 3, 1925, the tumor of the mandible was removed with the curet, along with the outer shell of bone covering it. Microscopic examination of the tissue removed revealed adamantinoma (fig. 2 *A*). On July 16 the right submaxillary and upper cervical lymph nodes were removed. Microscopic examination of these excised nodes revealed adamantinoma (fig. 2 *B*). Postoperatively roentgen and radium irradiation were employed.

The patient returned on Oct. 12, 1927, and examination revealed a recurrence of the adamantinoma involving the posterior extremity of the right horizontal ramus and a large portion of the ascending ramus (fig. 3 *A*). On October 26 the recurring tumor was widely destroyed with surgical diathermy (fig. 3 *B*). At the time of the last examination, six years later, there was no evidence of recurrence of the adamantinoma, either in the jaw or in the lymph nodes of the neck. Nine and a half years later (in April 1937) the patient wrote that she was "enjoying the best of health."

SUMMARY

Most of the benign cysts of the jaws arise as a result of proliferation of dental embryonic rests. They are readily amenable to appropriate conservative treatment.

The adamantinoma, likewise, arises from dental embryonic rests. It, however, is a malignant tumor, and radical surgical treatment is required for its cure.

"FUNCTIONAL" LOSS OF HEARING FOLLOWING INJURIES TO THE HEAD

PRELIMINARY REPORT

MORRIS ROSENTHAL, M.D.
NEW YORK

From my experience in examining patients for loss of hearing following injuries to the head, I have come to the conclusion that there is not that constant association between such injuries and loss of hearing which is assumed in the literature on the subject.

This is a preliminary report to determine the functional loss of hearing which follows trauma of the head of varying degrees.

I am defining functional loss of hearing from an industrial angle. Assuming that ordinary conversation is carried on within the frequencies 256, 512, 1024 and 2048 double vibrations, I am basing my deduction on the loss in decibels for these frequencies and calling it functional loss. Sonnenschein [1] said:

> It is now known that voice sounds range from 200 to 3000 D. V. If an individual can hear low tones below 200 D. V. and high tones above 3000 D. V. but cannot appreciate those frequencies lying within this range, he is unable to understand the spoken voice and is deaf for all practical purposes.

In the following 19 cases the patients were examined at Gouverneur Hospital within a day or two after admission or as soon as they became oriented. The cases were not especially selected.

A 6-A Western Electric audiometer, with soft rubber on the air conduction device, was used. In some of the cases no masking device was used when bone conduction was being determined. In others the Western Electric masking device was used. When the power output of the masking device was not sufficient to permit the patient to signify the presence of bone conduction or when the electric masking device confused the patient, air masking was used. This was done by having the patient hold a rubber tube opposite the opening of the external auditory canal of the ear to be masked while air was blown into the tube.

The criteria that I have used to determine normal hearing are those established by Fowler and Fowler [2] in a paper read before the Amer-

1. Sonnenschein, R., in Piersol, G. W.: Cyclopedia of Medicine, Philadelphia, F. A. Davis Company, 1932, vol. 4, p. 855.

2. Fowler, E. P., and Fowler, E. P., Jr.: Normal Hearing by Bone Conduction as Measured with an Audiometer, Ann. Otol., Rhin. & Laryng. **45**:754 (Sept.) 1936.

ican Otological Society on May 28, 1936, in which standards for normal hearing for the decades from 10 to 80 years were set. This standard is in general accord with the findings of Drury,[3] published in the *Archives of Otolaryngology.*

All patients recovered sufficiently to be discharged from the hospital.

REPORT OF CASES

Case 1.—M. C., a white man aged 49, met with an accident on Sept. 13, 1938. He was hit by a truck while walking and was dazed but not unconscious. He suffered laceration of the right side of the forehead just above the eyebrow. He had a dull headache, without vertigo, impairment of hearing or tinnitus. Neither ear drum showed hyperemia or trauma. The nose showed deviation of the septum to the left, with a bilateral mucopurulent discharge; the throat was normal. He gave a history of fracture of the nose twenty years previously. Cerumen was removed. A neurologic impression of cerebral concussion was recorded by Dr. Peterson.

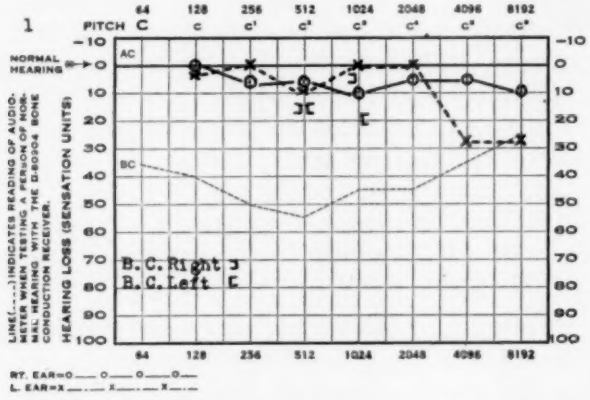

Chart 1 (case 1).—Audiogram made on Sept. 20, 1938. In this and the subsequent audiograms *B. C.* signifies bone conduction.

Roentgen examination did not show trauma of the skull. A spinal tap showed an initial tension of 13 mm. of mercury and a terminal tension of 6 mm. The cell count was normal.

Bone conduction was determined without masking. Air conduction was functionally normal. Trauma in the basal coil of the cochlea on the left was probable, though the injury was on the right side.

Case 2.—G. A., a white youth aged 18, met with an accident on Sept. 18, 1938. He was tackled and thrown to the ground while playing football; he "was unconscious for five or ten minutes," then walked home, one-half block away, went to bed for about one hour and then sat around the house. He had a headache for the next eighteen hours. The next morning he felt dizzy and vomited about fifteen or twenty times. He was brought to the hospital. A trauma was not demonstrable. The past otorhinolaryngologic history was noncontributory. The ear drums were

3. Drury, D. W.: Tests of Hearing of Five Hundred Average Ears by the Audiometer 2 A, Arch. Otolaryng. **1**:524 (May) 1925.

normal except for slight congestion around the malleus on each side. The nose and throat did not show any pathologic change. A neurologic impression of cerebral concussion was recorded by Dr. Peterson twenty-four hours after the accident. Roentgenograms of the skull did not show fracture. A spinal tap showed an initial pressure of 6 mm. of mercury and a terminal pressure of 4 mm. The cell count was normal.

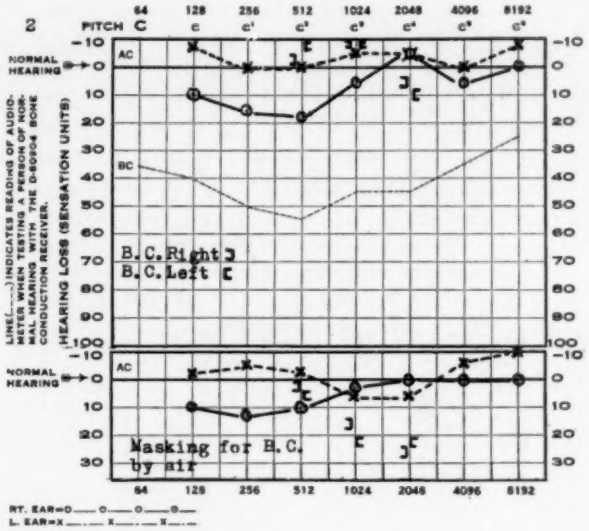

Chart 2 (case 2).—Above, audiogram made on Sept. 20, 1938. Below, audiogram made on Dec. 20, 1938.

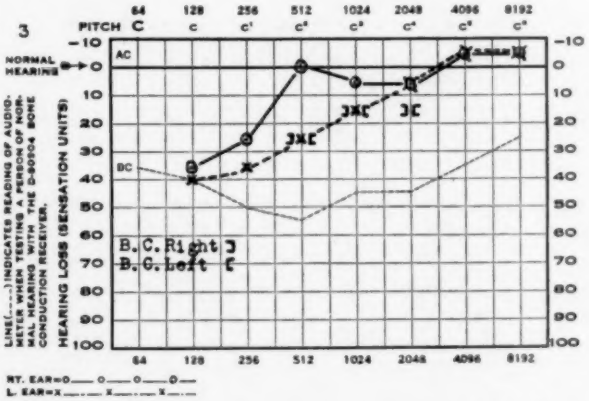

Chart 3 (case 3).—Audiogram made on Sept. 18, 1938.

Bone conduction was determined without masking. Air conduction was within the average normal limits.

Case 3.—M. A., a white man aged 28, a fireman, met with an accident on Sept. 17, 1938. As he was bending down, a newspaper roll fell on the back of his head.

He experienced a definite period of unconsciousness. On September 18 his symptoms were reported as a slight headache a few hours after the accident, without tinnitus or impairment of hearing. He gave a history of several operations for nasal polypi and treatment for sinusitis; the ears were normal. Neither drum showed trauma. A neurologic impression of cerebral concussion, with negative neurologic symptoms, was reported by Dr. Peterson. Roentgenograms did not show fracture of the skull. The cerebrospinal fluid was normal.

Bone conduction was determined without masking. Tests for air conduction showed loss for the lower frequencies due to the presence of polypi on the left and chronic sinusitis. Perception of the higher frequencies did not show trauma to the cochlea.

CASE 4.—A. C., a white boy aged 9, met with an accident on Sept. 23, 1938. He fell on his head and right shoulder while skating; unconsciousness was questionable;

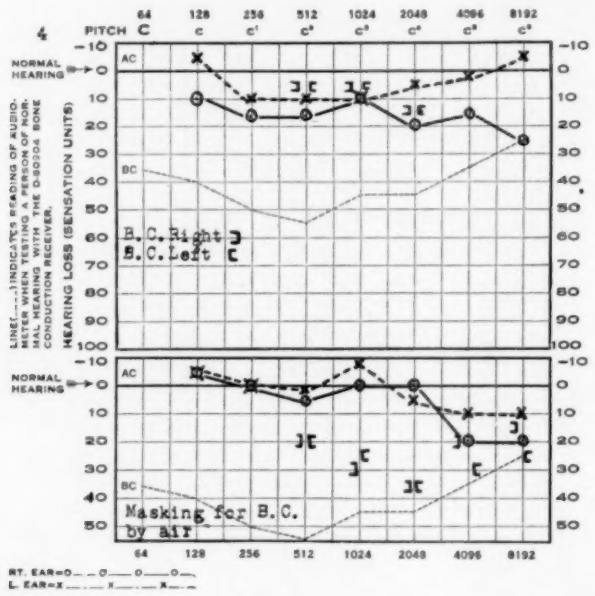

Chart 4 (case 4).—Above, audiogram made on Oct. 1, 1938. Below, audiogram made on Jan. 24, 1939.

he went home and complained of pain in the right shoulder and nausea, with persistent vomiting. He was brought to the hospital. There was no bleeding from the ears, nose or throat or evidence of trauma to the head. He complained of slight vertigo but not of loss of hearing. There was blood behind the right ear drum, with injection of the upper segment. Perception of C-11 was lateralized to the right. A neurologic impression of cerebral concussion and laceration into the right ear was reported by Dr. Peterson. The probability of fracture of the skull, suggested by Dr. Margaretten, was not confirmed roentgenologically.

Bone conduction was determined without masking. Tests for air conduction showed a loss on the right for the frequencies 2048, 4096 and 8192 and practically normal hearing for the lower frequencies. The loss was probably due to the bleeding behind the right drum.

Case 5.—S. J., a white man aged 40, an ambulance driver, met with an accident on Sept. 16, 1938. In a collision between the ambulance and a car he was thrown against the windshield, striking his head. He experienced a period of unconsciousness. He suffered slight abrasion on the bridge of the nose and fracture of a clavicle. On September 17 he did not have dizziness, tinnitus, impairment of hearing or vertigo. He had had furunculosis of the ears ten years previously. Both drums were slightly congested. A neurologic impression of cerebral concussion, without localized signs was reported by Dr. Peterson. Roentgen examination did not show fracture of the skull. The spinal fluid was normal.

Bone conduction was determined without masking. Tests for air conduction showed impairment of not more than 5 decibels for the frequencies 1024 and 2048.

Case 6.—T. V., a white man aged 53, met with an accident on Sept. 25, 1938. He was found lying at the foot of stone steps in a cellar after having been drunk all the previous day; he had probably been lying in the cellar all night. He was

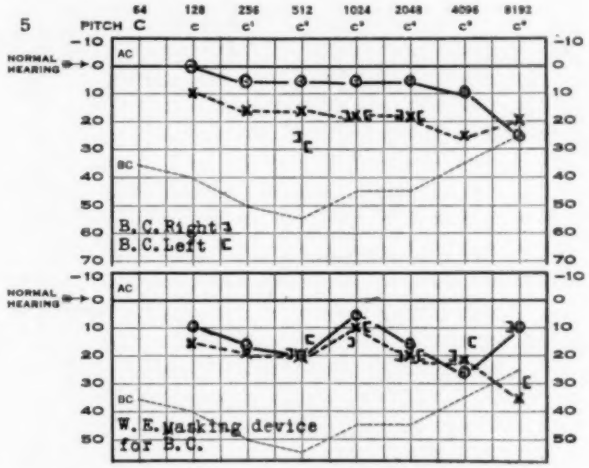

Chart 5 (case 5).—Above, audiogram made on Sept. 20, 1938. Below, audiogram made on Jan. 26, 1939.

bleeding from the left ear and from the skull on the left side. He experienced parietal and frontal headache on the left side, pain in the left ear, dizziness and bleeding from left ear, with partial loss of hearing on the left but no tinnitus in either ear. The eyes were normal, as was ocular motion; nystagmus was not present. The left ear drum was not visualized, because the canal was filled with wax and blood, but blood could be seen to ooze from the left ear. There was marked deviation of the nasal septum to the left. A neurologic examination indicating fracture of the base of the skull, concussion, contusion and possible laceration of the brain and contusion of the left parietal part of the scalp was reported by Dr. Dappolonia. The patient had complained of earache on several occasions prior to the injury. Roentgen examination on October 6 showed multiple fractures of the skull and parietal regions. The spinal fluid was blood stained, with an initial pressure of 12 mm. of mercury. The Wassermann reaction was negative.

Bone conduction was determined without masking. Tests for air conduction showed a loss for the higher frequencies, beginning with 1024 and 2048. This would indicate hemorrhages within the basal coil of the cochlea and a longitudinal fracture.

CASE 7.—J. K., a white boy aged 8, met with an accident on Sept. 25, 1938. He fell down a flight of stairs on the day before admission to the hospital, landing on his right collar bone; a history of unconsciousness was not elicited. He bled from the right ear. He did not experience vertigo or vomiting or complain of gross loss of hearing. He was not unconscious on admission; tenderness was present over the right parietal region. The right ear showed blood behind the drum; the left ear was normal. The neurologic status was normal, according to Dr. Peterson. Roentgenograms showed fracture of the skull and the right clavicle on September 26.

Bone conduction was determined without masking. There was marked loss of hearing by air conduction on the right, due to blood behind the right drum. Reex-

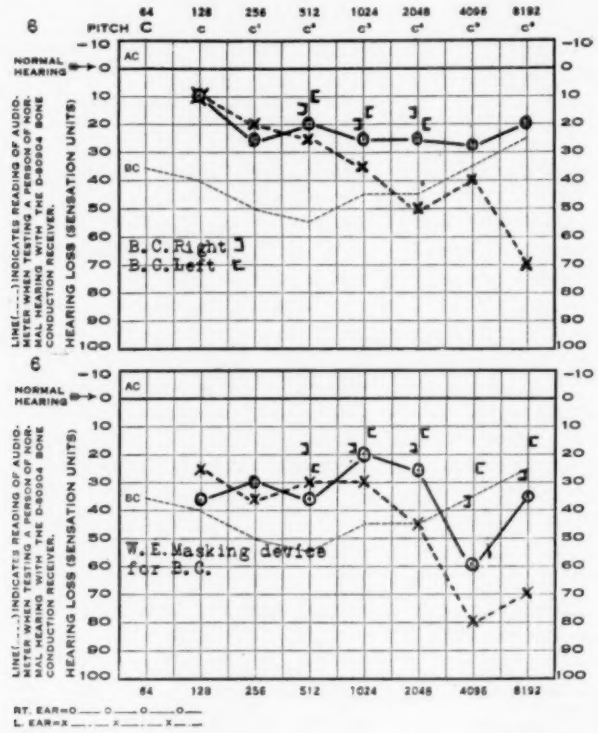

Chart 6 (case 6).—Above, audiogram made on Sept. 25, 1938. Below, audiogram made on Jan. 28, 1939. In this and the subsequent audiograms *W. E.* signifies Western Electric.

amination on December 22 showed the hearing within the normal range up to and including the frequency 4096 (C-5). The frequency 8192 (C-6) was heard at 35 decibels. With absorption of blood from the right middle ear, hearing returned to normal.

CASE 8.—M. M., a youth aged 16, met with an accident on Oct. 1, 1938. Riding on a bicycle, he was hit by a police car and thrown into the air; he hit the windshield of the car and was then thrown to the ground, landing on his head. He was unconscious on admission to the hospital; he suffered laceration of the right parietal

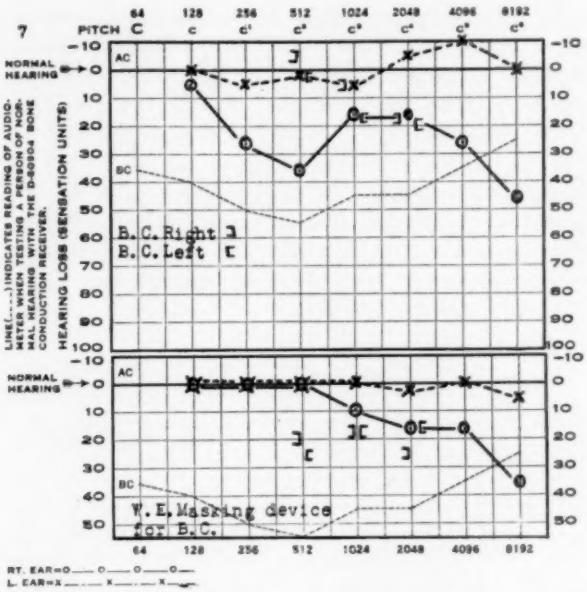

Chart 7 (case 7).—Above, audiogram made on Sept. 26, 1938. Below, audiogram made on Dec. 22, 1938.

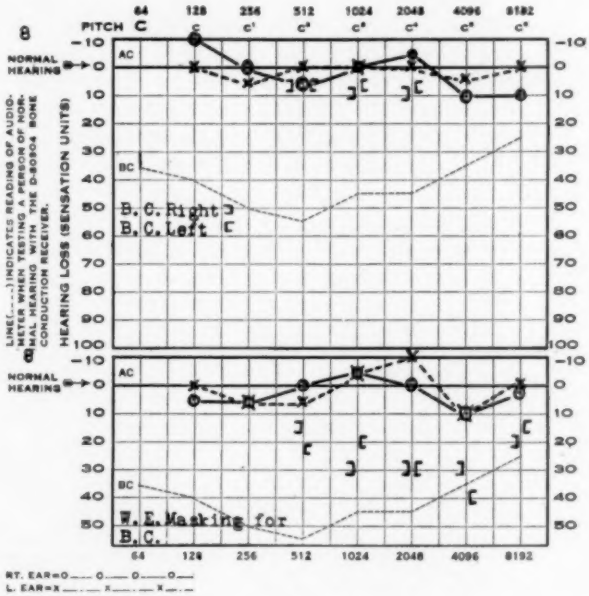

Chart 8 (case 8).—Above, audiogram made on Oct. 2, 1938. Below, audiogram made on Jan. 26, 1939.

region, without bleeding from the ears or the mouth. One day after the accident he had headache, without vertigo, dizziness, impairment of hearing or tinnitus. The past otorhinolaryngologic history was noncontributory. Blood was present behind both drums. The neurologic impression was mild cerebral concussion. In roentgenograms taken on October 3 the skull did not show fracture. The spinal fluid was under an initial pressure of 16 mm. of mercury; the appearance and cell count were normal.

Bone conduction was determined without masking. With blood in each middle ear, the hearing by air conduction was well within the normal limits. Evidence of trauma within the cochlea was not observed. Reexamination on October 14 showed an average increase of hearing for all frequencies of 10 decibels, due to absorption of blood from the middle ears.

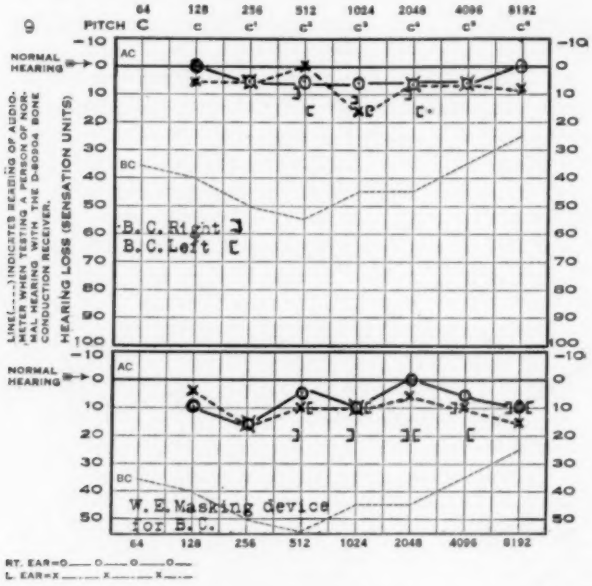

Chart 9 (case 9).—Above, audiogram made on Oct. 21, 1938. Below, audiogram made on Jan. 26, 1939.

Case 9.—C. P., a white girl aged 5, met with an accident on Oct. 10, 1938. She leaned over a rail on the third floor of a building and fell down a shaft, hitting her head, thigh and wrist in falling from side to side; she was not unconscious or dazed and did not show mental confusion or bleeding from the ears. She was rational, conscious and wide awake, without disturbance of speech or hearing. She suffered abrasions and hematoma over the left frontal part of the scalp. The ear drums did not show trauma. Neurologic examination indicated mild cerebral concussion. Roentgen examination on October 11 showed fracture of the skull and the left wrist. The spinal fluid was under an initial pressure of 6 mm. of mercury, with a normal appearance.

Bone conduction was determined without masking. Air conduction was within the normal limits.

Case 10.—D. J., a white boy aged 14, met with an accident on Oct. 17, 1938. He was pushing a car and turning a corner when he was struck by a passing car; he was unconscious until brought to the hospital; there was no bleeding from natural orifices, nausea or vomiting. He suffered avulsion of the skin and deep fascia of the right leg and shock but was rational and did not experience disturbance of hearing. The ears, nose and throat were normal. The neurologic impression was mild cerebral concussion and shock. Roentgen examination on October 18 did not show fracture of the skull; fracture of the tibia was seen. The spinal fluid was under an initial tension of 12 mm. of mercury and a terminal tension of 6 mm.; otherwise it was normal.

Bone conduction was determined without masking. Air conduction was normal. Reexamination on Jan. 24, 1939, showed a reading of zero for C-1, C-2 and C-3 and a drop of 5 decibels for C-4 and of 10 decibels for C-5 and C-6 on both sides.

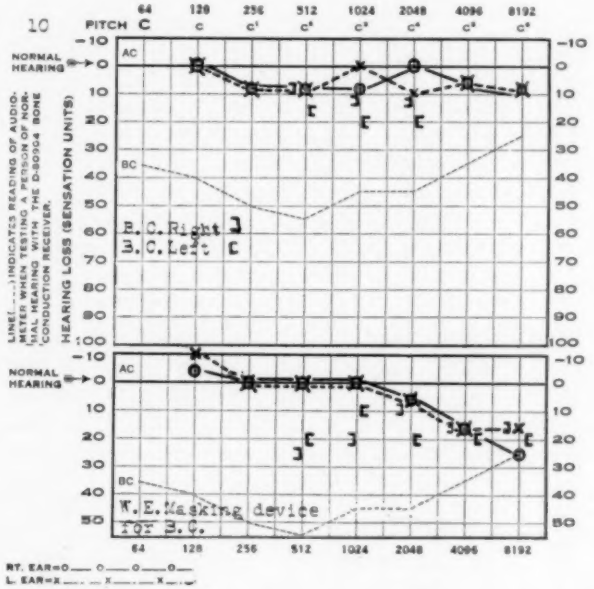

Chart 10 (case 10).—Above audiogram made on Oct. 21, 1938. Below, audiogram made on Jan. 24, 1939.

Case 11.—H. J., a Negro aged 26, met with an accident on Oct. 23, 1938. He was slugged from behind and was unconscious at the first blow; when he regained consciousness he went downtown in the subway. That night and the next day he had frontal headache and dizziness. He stayed in bed the next day and a half. He had experienced nausea and vomiting since the day after the accident. He came into the hospital from the outpatient department. He was lethargic and drowsy but conscious; his speech and responses were slow; he had not noted bleeding from natural orifices, tinnitus or loss of hearing. The right ear drum showed redness around the malleus; the left drum was normal. The nose and throat showed a profuse mucopurulent discharge. The neurologic impression was contusion and laceration of the cerebrum and subarachnoid and possibly subdural

hemorrhage. Roentgenograms showed no abnormality. A spinal tap showed an initial tension of 6 mm. of mercury and a terminal tension of 4 mm. with bloody and xanthochromic fluid.

Bone conduction was determined without masking. Tests for air conduction showed a slight loss, of about 5 decibels, for C-1 and C-3 in both ears and a loss of about 15 decibels for C-5 and C-6 on the right side. The functional hearing was almost normal.

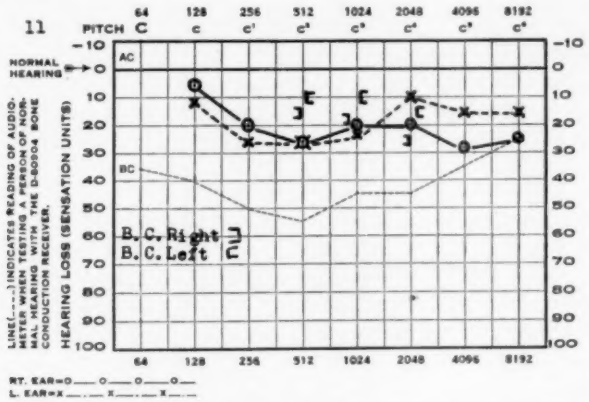

Chart 11 (case 11).—Audiogram made on Oct. 27, 1938.

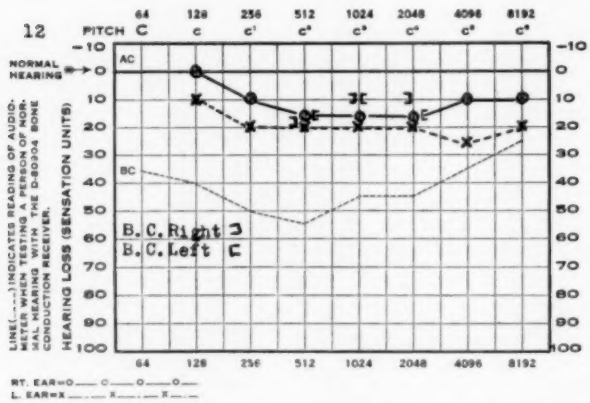

Chart 12 (case 12).—Audiogram made on Nov. 5, 1938.

CASE 12.—W. C., a Chinese man aged 35, met with an assault on Nov. 4, 1938. He was attacked while asleep and hit over the head, back and arms with a steel knife sharpener. He stated that he "lost consciousness for several minutes." He did not experience vomiting, tinnitus or loss of hearing. He suffered laceration of the occipital region of the skull, possible laceration of the left kidney and contusion of the right arm. Both eardrums showed evidence of chronic catarrhal otitis media, without evidence of trauma. There was a postnasal mucoid discharge; the tonsils were diseased. The neurologic impression was cerebral concussion and possible fracture of the skull. Roentgen examination was not performed. A spinal tap showed an initial pressure of 8 mm. of mercury; the fluid was clear.

Bone conduction was determined without masking. The functional hearing was practically normal. The slight loss that existed was probably due to pathologic changes in the nose and throat.

Case 13.—W. I., a white man aged 53, met with an accident on Nov. 4, 1938. While walking across the street he suddenly felt as if he had been blackjacked and then became unconscious. He was told that he had been hit by an automobile and had been unconscious about five minutes. Then he walked to the sidewalk and asked for help. He was brought to the hospital in an ambulance. He suffered laceration of the right frontal area, without bleeding from natural orifices, tinnitus or loss of hearing. The right ear drum was cloudy and slightly retracted; the left drum, markedly retracted, with congestion around the malleus. The nasal septum deviated to the left, occluding the lumen, which contained a mucopurulent discharge; a postnasal discharge was present. The neurologic impression was cerebral concussion and possible fracture of the skull. Spinal tap was refused by the patient. Roentgenograms did not show fracture of the skull.

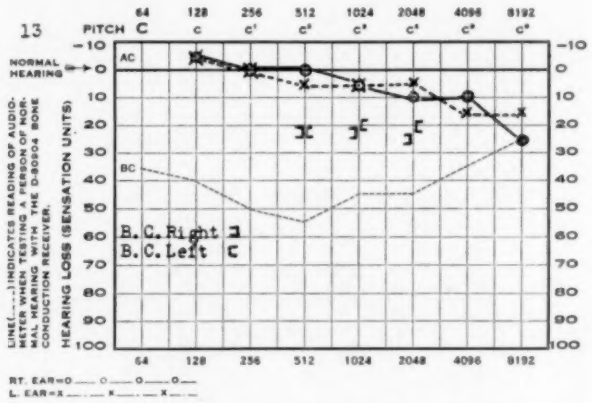

Chart 13 (case 13).—Audiogram made on Nov. 9, 1938.

Bone conduction was determined without masking. Air conduction was well within the normal limits. Functional loss of hearing was not observed.

Case 14.—D. P., a white youth aged 19, met with an accident on Nov. 9, 1938. He was assaulted by several men and knocked unconscious. He gave a history of impaired hearing on both sides due to chronic purulent otitis media, which was still present and was more marked on the right side. The right ear drum showed a large perforation, through which foul-smelling pus was discharging. The left drum was cloudy and retracted. A neurologic impression of cerebral concussion was reported by Dr. Peterson. A spinal tap showed an initial pressure of 14 mm. of mercury, which dropped to 12 mm. after 3 cc. had been withdrawn. The fluid was clear. By roentgen examination on November 14 no fracture of the skull could be seen.

Bone conduction was determined without masking. Tests for air conduction showed a definite loss, due to chronic purulent otitis media. The only possible traumatic loss might have been due to injury within the basal coil of the right cochlea, as indicated by an increase of 50 decibels in the perception of the frequency 8192 (C-6).

CASE 15.—N. I., a white woman aged 30, met with an accident on Nov. 12, 1938. Standing on a sidewalk, she was hit by an automobile; she became unconscious and was found in that state by the ambulance surgeon; she regained consciousness in the hospital; she was bleeding from the nose and had a jagged laceration over the left eye. She had had an abscess in the left ear a number of years previously, which was incised and drained for a short time and left the hearing on the left side markedly impaired. The right ear drum showed slight retraction and congestion of

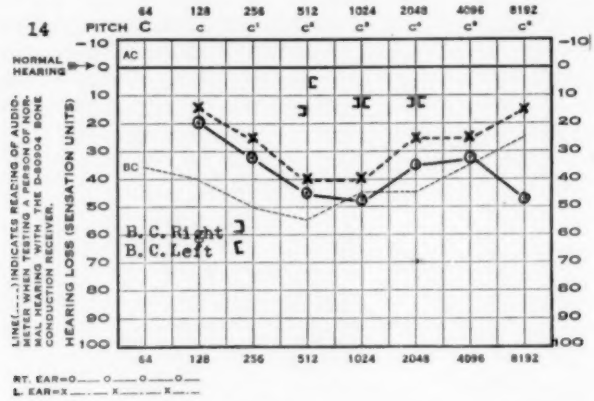

Chart 14 (case 14).—Audiogram made on Nov. 15, 1938.

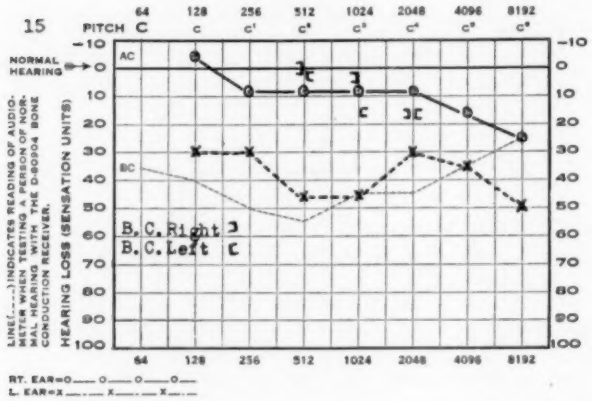

Chart 15 (case 15).—Audiogram made on Nov. 16, 1938.

the anterior segment. The left drum showed a large central perforation without any discharge. A neurologic impression of cerebral concussion and possible fracture of the skull was reported by Dr. Dappolonia. The spinal fluid was bloody, with an initial pressure of 8 mm. of mercury. Roentgen examination on November 14 showed a linear fracture involving the left vault of the frontal region, extending from the orbital ridge backward.

Bone conduction was determined without masking. Tests for air conduction on the left showed marked loss due to previous chronic purulent otitis media.

Case 16.—K. B., a white woman aged 27, met with an accident on Dec. 5, 1938. She was riding in the back seat of an automobile when it was struck from behind and she was thrown forward, striking her forehead and hip against the side of the car. She suffered laceration over the left eye and a transient period of unconsciousness. She did not note dizziness, vertigo, vomiting or impairment of hearing. The right ear drum was cloudy on the posterior segment, with slight reddening around the malleus. The left drum was cloudy over its entire extent and retracted. The nasal septum deviated to the right; the tonsils were submerged. The neurologic impression was cerebral concussion. The results of a spinal tap were negative. Roentgen examination did not show fracture of the skull.

Bone conduction was determined with a Western Electric masking device. Air conduction was well within the normal limits.

Case 17.—S. L., a white boy aged 15½, was admitted to the hospital on Jan. 1, 1939, after an accident on the same date. He gave a history of having been struck by a fist and knocked unconscious for a few minutes. On admission, one-half hour

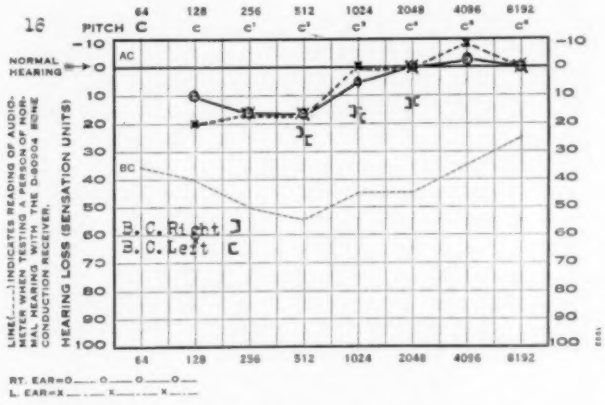

Chart 16 (case 16).—Audiogram made on Dec. 8, 1938.

after the accident, he was conscious and oriented; he bled from the right ear and the right nostril. He did not experience dizziness or buzzing or complain of loss of hearing. Examination showed subconjunctival hemorrhage in the lateral aspect of the right eye. Ecchymosis of the upper right eyelid and bleeding from the right ear and nostril also were present. The right auditory canal showed a fistulous opening from the posterior wall to the antrum, filled with clotted blood, and after this was wiped away there was a scanty foul-smelling discharge; blood clots were seen on the drum; the drum was irregularly adherent; perforation had not occurred. The patient gave a history of chronic purulent otitis media of several years' duration, with mastoidectomy performed on the right by the endaural method. The neurologic impression was negative. Roentgenograms did not show fracture of the skull. The spinal fluid was slightly bloody.

Bone conduction was determined with masking by air. Air conduction was well within the normal limits on both sides, despite previous chronic purulent otitis media on the right. There was a loss for C-5 and C-6 on both sides, probably due to trauma within the basal coil of the cochlea. The functional hearing was normal.

Case 18.—C. H., a Negro aged 44, was admitted to the hospital on Dec. 30, 1938, with a history of an attack of unconsciousness six days previously, which lasted several minutes. In April 1937 he had been struck over the left side of the head with a club and knocked unconscious; he had remained unconscious for about one month at the Harlem Hospital, where decompression and craniotomy were done, and had remained in the hospital forty days. After the injury he had had polyuria and polydipsia. Convulsions developed starting about August 1938. They were

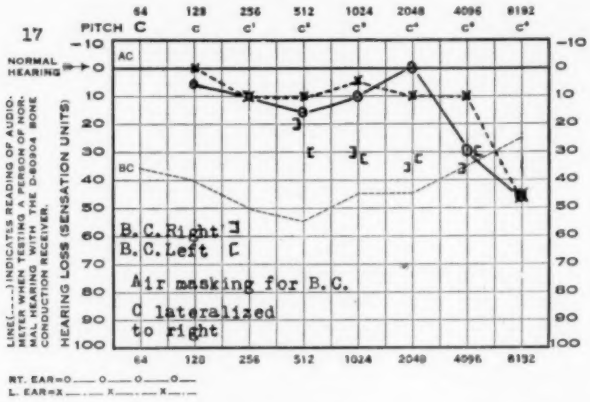

Chart 17 (case 17).—Audiogram made on Jan. 3, 1939. *C* signifies perception for 128 double vibrations.

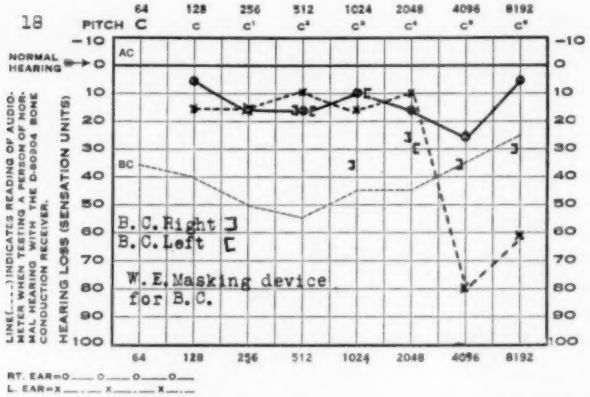

Chart 18 (case 18).—Audiogram made on Dec. 31, 1938.

not preceded by aura. He had had an attack six days previously, at which time he injured his head and elbow. Examination of the nose showed the septum deviated to the right, partly occluding the lumen, and a mucopurulent postnasal discharge. That of the ears showed the right drum retracted and cloudy, the left drum perforated at the anterior-inferior quadrant and no discharge. The neurologic impression was that the right pupil was slightly oval, rigid to light and slightly larger than the left and reacted slowly. The left pupil did not react to light; the field

of vision on both sides was somewhat contracted. The deep reflexes were all exaggerated, but the right abdominal reflexes were less so than the left. Romberg's sign was manifested as a tendency to sway to the left. A depression was noted over the left temporal area, the site of the previous operation. An encephalogram made on Jan. 4, 1939, showed atrophy of the brain on the left side. The lateral ventricles were dilated, especially on the left, involving the anterior and lateral horns.

Bone conduction was determined with a Western Electric masking device. Tests for air conduction showed a marked drop for C-5 and C-6 on the left, due to trauma within the basal coil of the cochlea. The functional hearing was normal.

CASE 19.—B. B., a white man aged 46, was admitted to the hospital on Jan. 1, 1939, with a history of falling while cleaning windows on the fifth floor of a building. He tried to grab a projecting sign, after which he remembers nothing until he found himself in the hospital. The ambulance surgeon said: "The patient was not unconscious when brought into the hospital but disoriented; blood flowed from the left ear but not from the nose or throat." At examination on January 21 the

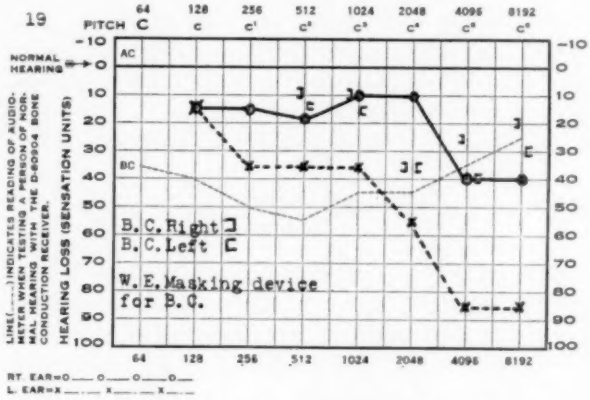

Chart 19 (case 19).—Audiogram made on Jan. 21, 1939.

patient said that he felt sick but not dizzy. Symptoms of vertigo were not present; spontaneous nystagmus did not occur, nor was vertigo elicited with the eyes at the extreme angle at each side; the patient did not complain of buzzing or loss of hearing. Slight deviation of the nasal septum to the right was noted, with pus in both sides. The throat contained a small amount of thick postnasal discharge, with thin streaks of blood. Both external auditory canals were filled with inspissated wax. The drum on each side was bluish (the middle ears contained blood), with congestion in the superior parts and around the malleolus on each side. The neurologic impression on Jan. 18, 1939, was that the patient was semiconscious and lapsed into unconsciousness at times. He had suffered a laceration over the forehead which came down to the frontal groove, where there seemed to be a depression of the frontal bone, and over the left parietal and frontal region extending to the bone, with no evidence of fracture at that point. The pupils were irregular and reacted to light and in accommodation. There was a laceration at the extreme edge of the external angle of the right eye and over the bridge of the nose. The abdominal reflexes were present and active. The deep reflexes were present. Babinski's sign was absent. Blood was issuing from the left ear. The diagnosis was cerebral concussion and fractured skull.

COMMENT

A review of the cases gives data only partially in agreement with those obtained by other investigators. Shambaugh [4] said, "I have never been convinced that a blow on the head can result in only a partial loss of hearing." Fletcher [4] interpreted this remark to mean that there was either a total loss of hearing or none. Grove [5] reported that in the examination of 42 patients with injuries to the head he discovered 31 with impairment of hearing. He cited Passow,[6] saying that "in severe injuries to the skull, the ear practically never remains intact." Stenger [7] noted that the temporal bone is involved in the heavy swinging movements incident to injury of the skull and that its contents must be thrown into violent commotion by the blow and thereby damaged. Ulrich [8] reported on the microscopic examination of the temporal bone in 18 cases of basal fracture of the skull, and noted signs of injury to the cochlea in all cases. Grove [5] concluded that the pathologic changes in human beings following injury to the head consist "of hemorrhages in various places, the site of predilection being the perilymph spaces in the basal coil of the cochlea." Theodore [9] made postmortem observations on a man who had had injuries to the head twelve and twenty-two years before and reported degenerative changes, particularly in the cochlea. Barnick [10] said that the loss of hearing for the high tones in cases of injury to the head with recovery is due to trauma of the basal coil of the cochlea. Bunch [11] concluded that

4. In discussion on Fletcher, H. A.: Determination of Disability as to Loss of Hearing, and the Importance of Vertigo in Industrial Accident Cases, J. A. M. A. **79**:529 (Aug. 12) 1922.

5. Grove, W. E.: Otologic Observations in Trauma of the Head: Clinical Study Based on Forty-Two Cases, Arch. Otolaryng. **8**:249 (Sept.) 1928.

6. Passow, A.: Die Verletzungen des Gehörorgans, Wiesbaden, J. F. Bergmann, 1905; cited by Grove.[5]

7. Stenger: Ueber die Arten der nach Kopfverletzungen auftretenden Neurosen: Die traumatische Labyrinthneurose, Deutsche med. Wchnschr. **31**:63, 1905; cited by Grove.[5]

8. Ulrich: Klinische und anatomische Untersuchungen über Verletzungen des Gehörorgans bei Schädelbasisfrakturen, Schweiz. med. Wchnschr., 1921, p. 24; cited by Grove.[5]

9. Theodore, E.: Beitrag zur Pathologie der Labryintherschütterung, Ztschr. f. Ohrenh. **61**:299, 1910; cited by Grove.[5]

10. Barnick, O.: Ueber Brüche des Schädelgrundes, und die durch sie bedingten Blutungen in das Ohrlabyrinth, Arch. f. Ohrenh. **43**:23, 1897; cited by Grove.[5]

11. Bunch, C. C.: Symposium: Neurol Mechanism of Hearing; "Nerve Deafness" of Known Pathology or Etiology; Diagnosis of Occupational or Traumatic Deafness, Historical and Audiometric Study, Laryngoscope **47**:615 (Sept.) 1937.

when a dip occurs at 4096 double vibrations (C-5) acoustic trauma should be suspected. Linthicum and Rand [12] noted that in "functional" hearing tests made on 32 patients with injuries to the head only 6 failed to show some inner ear deafness. In the cases under review, there is to be noted a smaller percentage of involvement of the cochlea than in those reported in the literature just mentioned.

Unconsciousness and Labyrinthine Reactions.—Grove [5] noted unconsciousness in 29 cases. In my series there were 15 cases of unconsciousness. Labyrinthine reactions, either caloric or rotatory, could not be obtained on account of the condition of the patients, who as a result of their injuries were kept flat in bed. However, I attempted to observe the presence of labyrinthine involvement by questioning the patients as to vertigo and noting the presence or absence of spontaneous nystagmus. Symptoms of vertigo were found in 6 patients (cases 2, 4, 6, 11, 18 and 19). In no patient were these symptoms marked. Nystagmus was not noted in any of these patients. In this respect my findings differ from those of Grove,[5] who reported nystagmus in 29 patients in his series, and of Brunner,[13] who examined 60 patients with commotio cerebri and found nystagmus in 52. It is possible that transient nystagmus may have been present in my series, but, if so, it was not noted by the ambulance surgeon or the nurse in the accident ward, both of whom had been instructed to watch for this condition. The neurologists who examined the patients within twenty-four hours after their admission made no note of such a condition, nor did I find nystagmus in any of the patients when I examined them, within a few days after their admission, or as soon as they were oriented.

Bleeding from the Ears or Blood in the Middle Ear.—Borden [14] found bleeding in 221 of 408 cases. According to Grove,[5] Phelps,[15] who found bleeding in 285 of 1,000 cases, "held that hemorrhage from an ear is an absolutely diagnostic sign of a fracture of the temporal bone." Grove [5] noted bleeding in 9 cases. This agrees with the findings in my series, in which 6 patients showed blood in the ears (cases 4, 6, 7, 8, 17 and 19).

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12. Linthicum, F. H., and Rand, C. W.: Neuro-Otological Observations in Concussion of the Brain, Arch. Otolaryng. **13**:785 (June) 1931.

13. Brunner, H.: Pathologie und Klinik der Erkrankungen des Innenohres nach stumpfen Schädeltraumen, Monatschr. f. Ohrenh. **59**:697, 1925; cited by Grove.[5]

14. Borden, C. R. C.: Otologic and Rhinologic Complications of Skull Fracture, J. A. M. A. **53**:429 (Aug. 7) 1909; cited by Grove.[5]

15. Phelps, C.: An Analytical Review of One Thousand Cases of Head Injuries, Ann. Surg. **49**:449, 1902; cited by Grove.[5]

A second audiogram in case 4, taken four months after the initial examination, showed that with the absorption of blood from the right middle ear the hearing for the middle frequencies, from 256 to 2048 double vibrations, inclusive, was improved more than 10 decibels, although there was not much loss of hearing at the time of the accident. However, the hearing for 4096 and 8192 double vibrations was not improved on the right and had decreased on the left. This might be interpreted as being due to permanent trauma in the basal coil of the cochlea on the right in a limited area and possibly a delayed hemorrhage in the basal coil of the cochlea on the left. A more marked decrease in the impairment of hearing is to be noted in case 7. In view of the accepted theory that there can be no regeneration in the organ of Corti, the diminution in the loss of hearing for 4096 and 8192 double vibrations must be due to absorption of the blood within the cochlea. The presence of blood behind both drums in case 8 did not cause any complaint of loss of hearing on either side, although its absorption three weeks later caused an increase in the auditory threshold for 1024 and 2048 double vibrations, but the dip at 4096 double vibrations remained. The complaint of loss of hearing does not seem to have any positive significance. In Grove's [5] series of 42 cases, 14 such complaints were made, although on examination he discovered permanent deafness in 31 cases. In my series of 19 cases, only 1 complaint of impaired hearing was made, although several of the patients had hard wax in the ears and some had blood in the middle ear. If one is to explain the absence of any complaint of loss of hearing in the patients who had wax in the ears by the slowness of the process of accretion, then how is one to account for the lack of complaint of impairment of hearing in cases in which the middle ear is suddenly filled with blood? Some of my patients who had blood in the middle ear but did not complain of impaired hearing showed on audiometer tests made several months later an improvement in the threshold of hearing of from 10 to 15 decibels.

Tinnitus.—In the series of cases that I am presenting, there was no complaint of tinnitus lasting an appreciable time after the injury. In contradistinction to these findings, Grove [5] reported 7 cases of tinnitus in his series, and Brunner [13] noted the presence of tinnitus in 34 of 60 cases.

Loss of Hearing.—In all the cases reported by various observers, a loss of hearing was assumed to exist whenever there was a drop from the threshold of perception for any frequency over the entire tonal range. Grove [5] cited 12 cases which he classified as instances of loss of hearing in which there was a drop at 4096 double vibrations only.

although he said that these persons would not ordinarily be considered to have any loss of hearing.

Linthicum and Rand [12] did not note the degree of loss of hearing in any frequencies in their series of 32 cases, but merely stated that hearing was abnormal or that abnormality in hearing was not present. Bunch,[11] who gave the audiometer readings of 9 patients who had been exposed to the noise of the explosion of small arms, noted on page 640 that subjects 1, 2, 3, 5 and 8 were not aware of loss of hearing because the loss was above the range of the spoken voice, that is, above 2048 double vibrations, and concluded: "Tests with a set of tuning forks which did not contain a C-5 (4,096 d.v.) fork would reveal losses in but a very few [cases]." In my series of 19 cases there are 3 (cases 6, 7 and 19) in which a definite loss of hearing after the accident was demonstrated by the audiometer. In 1 of these (case 7) the hearing improved after the absorption of blood from the middle ear. In case 15 there was unilateral loss of hearing on the left due to previously existing chronic purulent otitis media, but the loss for the higher frequencies may have been due to trauma within the basal coil of the cochlea resulting from the accident. This patient registered no impairment of hearing on the left. In case 14 there was bilateral loss of hearing due to a long-standing otitis media. However, divergence of hearing for 8192 double vibrations on both sides is to be noted, the drop on the right being due to trauma. In case 19 a test has not been made since the original examination, and no deduction can be made. There are in this series only 2 cases in which the loss of hearing can be demonstrated, and both are cases of extremely severe injury, with fracture at the base.

SUMMARY

Nineteen cases, with audiometer charts, are presented.

Concussion was diagnosed by the neurologist in all cases.

Unconsciousness was noted in 15 cases.

Fracture of the skull was shown roentgenographically in 5 cases.

The patient complained of vertigo (nausea, vomiting and dizziness) in 6 cases.

Nystagmus was not noted in any case.

Tinnitus after the first day was not noted in any case.

Blood was seen in the middle ear in 6 cases.

Loss of hearing for the higher frequencies was noted in 9 cases, in 3 of which it was bilateral.

Loss of hearing within the "functional" range was noted in 2 cases, in both of which it was unilateral.

CONCLUSION

A review of the cases presented suggests that impairment of hearing does not follow injuries to the head as commonly as is generally accepted, but that the trauma most often occurs in the basal coil of the cochlea with impairment for perception of the higher frequencies, above 2048 double vibrations, which does not, by itself, produce "functional" loss of hearing.

Case Reports

DEFORMING AND RECURRING POLYPS OF YOUTH

HERMAN I. LAFF, M.D., DENVER

The finding of nasal polyps is common and ordinarily does not provoke unusual interest in the rhinologist. He expects to encounter them frequently in allergic and vasomotor nasal disturbances and in some types of suppurative sinal disease, especially ethmoiditis. Less often he finds them in association with malignant growths of the nose and sinuses, nasopharyngeal fibromas, syphilis, lupus and foreign bodies. He recognizes the etiologic relation of a solitary choanal polyp to diseased antral mucous membrane.

Experience, moreover, has taught him that nasal polyposis is almost exclusively a disease of adult life, except the choanal form, which not infrequently occurs in children. The finding of extensive multiple polyps in childhood would in itself be unusual, but its association with extreme external nasal deformity should stamp the case as worthy of study. This impression gains strength in view of the surprisingly few references to the syndrome in the literature.

Covili-Faggioli [1] credited Canuyt and Terracol [2] with being the first, in 1923, to describe the symptom complex which the latter termed "deforming and recurring polyps of youth." A search through the *Quarterly Cumulative Index Medicus* since 1917 has failed to reveal any reference to this entity in the American literature. Most of the relatively few references available are either to French or to Italian sources.

I have recently had a boy under my care with the most extreme polyposis I have ever seen, associated with a markedly disfiguring nasal deformity, which I undertook to correct by plastic repair after removal of the polyps.

REPORT OF A CASE

A. P., a boy aged 15, referred by Dr. I. Girsh, came to my office on Dec. 22, 1936, complaining of asthma, difficulty in nasal breathing and external deformity of the nose. He had had nasal trouble and asthma since he was 7 years of age, the onset following a cold. He had had polyps removed from his nose by other physicians on four different occasions, but with only temporary relief. The polyps were first removed at the age of 9. The asthmatic attacks occurred throughout the year. Allergic tests followed by dietary regimens had not been of much help in controlling the asthma. For the past few months the growths had been seen protruding from each nostril. The father, mother and 2 brothers are living and well. The maternal grandfather was said to have had asthma. Wassermann tests of the patient and each parent were reported negative.

1. Covili-Faggioli, G.: Deforming and Recurring Nasal Polyps in a Boy of Thirteen, Boll. d. mal. d. orecchio, d. gola, d. naso **53**:346 (July) 1935.

2. Canuyt, G., and Terracol, J.: Deforming and Recurring Nasal Polyps of Youth, Arch. internat. de laryng. **30**:143 (June) 1924.

Examination revealed an enormous distention of the nose, producing disfigurement of both bony and cartilaginous portions. The nasal bones were separated at the dorsum, with flattening of the bridge. The ascending processes of the superior maxillas were flared outwardly. The cartilaginous framework of the nose was equally distended. This, together with the bony protrusions, produced an unnatural

Fig. 1.—Left, photograph of the patient before the operations, showing the deformity of the nasal pyramid. Right, photograph of the patient after the removal of the polyps and the nasal plastic repair.

Fig. 2.—Photograph of the polyps removed from both sides of the nose, not including the polypoid masses removed from the ethmoid sinuses, which were almost equal to those illustrated.

and grotesque appearance (fig. 1 *A*). The interior of the nose was filled with closely packed masses of polypoid tissue, protruding and visible at the external nares. The growths were also seen extending into the choanae. The chest was barrel shaped and emphysematous. Extreme kyphosis and pigeon breast with prominent costochondral junctions were noted.

The nose was freed of polyps after three sittings, with the area under cocaine mud anesthesia, which was necessary on account of their enormous number and marked tendency to bleed.

After the nasal cavities had been cleared the patient was hospitalized, and bilateral ethmoidectomy performed. At that time masses of edematous tissue from the ethmoid labyrinths, at least equal in amount to the previously removed material, were exenterated.

It was hoped that the nasal configuration would in time alter and recede to more natural proportions, but after seven months little or no improvement could be detected. I therefore decided to narrow the nose by a plastic procedure similar to that employed in the commonly performed intranasal rhinoplasty. Utilizing the intranasal incision on each side, I elevated the skin and periosteum overlying the nasal bridge, sawed through each ascending process and approximated the fragments, thus narrowing the nasal bridge. Comparison of the photographs taken before and after operation show the improvement obtained (fig. 1).

Nasal polyps are seldom found in the young. Thomson [3] quoted Lacoarret, who found them in only 6 of 10,000 patients, the youngest being 6½ years old. The solitary choanal polyp, on the other hand, is said to be more common in patients under 20 years of age.

No longer considered an example of a myxomatous tumor or an edematous fibroma, the nasal polyp is now generally regarded as produced by long continued edema of the nasal and sinal mucous membranes. Especially in the case of polyps arising from the ethmoid labyrinth, discussion regarding pathogenesis used to center around the part played by the underlying bone. There were those who described the process as "necrosing ethmoiditis," believing it to be a disease originating in the bone, while others maintained that the changes in the adjacent bone could be explained as secondary to the primary alterations in the mucous membrane (rarefying ethmoiditis).

In 1923 Canuyt and Terracol,[2] at the French Congress of Otorhinology, described their experience with the symptom complex of polyps occurring in the young, under the heading of "Deforming and Recurring Polyps of Youth." They found as characteristic symptoms (1) generalized polyposis of both middle meatuses, (2) necrosing ethmoiditis, (3) deformity of the bony nasal pyramid and (4) recurrences in spite of intervention.

Covili-Faggioli [1] in 1935 reviewed this subject and added a case report of his own. In this contribution he cited reports by various authors but included among other types many references to juvenile nasal polyposis caused by congenital syphilis. In most of these, deformity of the nasal pyramid did not exist. Only the following citations in his article appear to fall into the category under discussion, i. e., recurring nasal polyps in the young producing facial disfigurement.

Ferraris [4] in 1928 reported on 2 patients whom he had treated for polyposis and external nasal deformity, one a boy of 12 years and the other a boy of 18, for both of whom the Wassermann tests were negative.

3. Thomson, St. C.: Diseases of Nose and Throat, ed. 4, New York, D. Appleton-Century Company, Inc., 1937, p. 187.

4. Ferraris, G.: Symptoms and Diagnosis of Deforming and Recurring Polyps of Adolescence, Ann. di laring., otol. **29**:266 (Sept.) 1928.

Fotiade [5] in 1928 reported the case of a boy of 14 with multiple recurring polyps destroying almost the entire nasal septum. The extent of external deformity, if any, was not mentioned. The Wassermann test was negative.

Aloi [6] in 1929 described a youth presenting this symptom complex and referred to the procedure adopted in improving the external nasal deformity.

Leroux [7] in 1930 related his experience with a youth who in addition to the polyps and deformity of the nasal bones presented bilateral exophthalmos. The Wassermann test was negative.

Regarding my patient, it appears that asthma played a definite etiologic role, since he had manifested symptoms of the disease since he was 7 years of age. At the time of writing he still has paroxysms requiring epinephrine for relief. I am of the opinion that the polyps originated as the result of a long-continued swelling of the nasal mucous membranes associated with the asthma, a point of view which coincides with that generally held today on the ordinary types of nasal and bronchial allergy. One need not assume a primary disease of the bone such as is implied by the term necrosing ethmoiditis.

When polyps commence at such an early age and in the presence of an exceptionally severe edematous reaction, they undoubtedly exert a powerful expanding pressure on the relatively soft and yielding nasal framework. This, together with the fact that the sutures between the various bones in this region are not firmly united, results in bizarre deformity.

Congenital syphilis as a chief cause of the condition is an assumption that hardly seems tenable, in view of the relatively few instances in which it could be proved in the cases cited in the literature. The relation appears to exist chiefly by virtue of the fact that in congenital syphilis edema of the nasal mucous membrane with consequent formation of polyps also is apt to occur in the young.

In contradistinction to the findings in this patient it is interesting to compare what Duke [8] in 1930 described as a typical deformity of the bones of the face caused by perennial nasal allergy in childhood.

This was said to consist of a depression and flattening on each side of the nose probably caused by inadequate development of the ethmoid cells and antrums. Duke stated the belief that this lack of natural development was due to prolonged interference with the normal ventilation of the sinuses from narrowing and closure of their ostiums by the edematous membranes.

The deformity is unlike that caused by enlarged adenoids and mouth breathing. The earliest sign is a depression on each side of the nose near the inner canthi, followed later by similar depressions over the adjacent ascending processes and antrums. This results in undue prominence of the zygomatic arches—a common observation in asthmatic adults.

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5. Fotiade, cited by Covili-Faggioli.[1]

6. Aloi, V.: Deforming Polyposis of Nasal Fossae: Surgical Treatment; Two Cases, Riforma med. **45**:373 (March 16) 1929.

7. Leroux, cited by Covili-Faggioli.[1]

8. Duke, W. W.: Deformity of the Face Caused by Nasal Allergy in Childhood, Arch. Otolaryng. **12**:493 (Oct.) 1930.

Duke stated the belief that the type of facies he described may make its appearance in a child within a year of the time of onset of perennial nasal allergy and can be relieved in a similar time if the allergy is completely controlled. He said that it remains permanently if carried over into adult life. He expressed the belief that seasonal allergy per se is not capable of producing such a deformity. In his opinion its association with asthma is common and "should indicate to the physician that nasal allergy probably does exist."

My patient presented symptoms of undoubted perennial nasal allergy from early childhood yet acquired a deformity quite different from that usually found. Since polyposis in early life is rare, the exceptions described by Duke are also uncommon. It is, of course, obvious why extreme polyposis by mechanical pressure will erase the typical deformity that Duke mentioned and in its stead produce swelling in the very parts that would otherwise appear depressed. For the same reasons, the infantile sinuses which should exist according to Duke's conceptions, become enormously distended.

The number of polyps removed in this case was larger than I have ever experienced; nor have I ever seen these growths produce such extreme external deformity of the nose.

The plastic procedure was undertaken not only for cosmetic reasons but in an attempt to obtain narrowing of the distended nasal fossae which remained after operation.

As was to be expected the polyps have recurred and have been removed since the nasal plastic procedure. It is hoped that by eradicating them before they have multiplied in such quantities as to produce symptoms of pressure recurrence of external deformity will be prevented.

CONCLUSIONS

An unusual case of extreme nasal polyposis with external facial deformity in an asthmatic youth has been presented.

This symptom complex has been described in foreign literature since 1923 but apparently has found but little or no mention in American periodicals.

It is believed that the deformity occurs from the effect of gradual pressure of the polypoid masses on the developing sinal walls and that so-called necrosing ethmoiditis and congenital syphilis do not necessarily produce it.

It is important that polyps occurring in childhood be removed early and subsequently if necessary in order to prevent facial deformity.

Facial deformity may be improved by the usual intranasal rhinoplastic repair. Maintenance of the cosmetic result will depend on the adequate control of the recurring polyps.

227 Sixteenth Street.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

PURULENT OTITIS MEDIA, MASTOIDITIS, SINUS THROMBOSIS AND SUPPURATION OF THE PETROUS PYRAMID

SAMUEL J. KOPETZKY, M.D.
NEW YORK

In the survey of the year's literature there appears a change in the trend of research reported. In this country particularly and in the Scandinavian countries also, otologists are primarily concerned with specific otologic problems which are as yet unsolved. The reports seem less concerned with the general topic of infections in the tympanomastoid area than with a search for solutions of definite problems created by infection. Only in the Russian and German literature are reports recorded of new local remedies for acute suppurative otitis. Knowledge of suppuration of the petrous pyramid is becoming, so to say, stabilized. Less rigid adherence to procedures routinely advocated is generally noted. It is indeed gratifying to record from both at home and abroad that a better comprehension both of the general symptoms and of the specific signs and symptoms which permit definite localization of the lesion is apparent. The general term "petrositis" is being supplanted by distinct localizing designations. There is evident also a mounting record of recoveries. In a study of the literature it is noteworthy that the popular laissez-faire attitude of a few years ago has definitely passed. Hardly any stress is placed on the contention that almost all petrosal suppurations cure themselves spontaneously. Some still do, as they always did. What is realized now as never before is that when a given suppuration does not tend toward spontaneous recovery adequate surgical intervention is indicated. The stress placed on this by the pioneer workers in the field has been fruitful in saving many otherwise lost lives. No better general commentary on the changed attitude is needed than the words of Dr. Joseph C. Beck [1] when, during the discussion of a symposium on

From the Department of Otolaryngology, Beth Israel Hospital.

1. In discussion on Lindsay, J. R.: Suppuration of the Petrous Pyramid, Arch. Otolaryng. **27**:652 (May) 1938.

petrositis before the Chicago Laryngological and Otological Society, he said, among other things,

> . . . when this work on the petrous pyramid was first brought out and surgical intervention enthusiastically spoken of, I was unhappy about the whole thing and said to myself, "Now we will have a holocaust of deaths from this enthusiasm." After going through the literature and checking the cases reported . . . , including 2 cases in which operation was successfully performed by my associate, Dr. M. R. Guttman, I am glad to say that I have lived long enough to change my mind.

The basic clinical picture of petrosal suppuration is so generally comprehended now by most clinicians that the variations from the classic symptoms have become the object of study and an evaluation of atypical symptoms is in progress.

A more scientific approach is noticeable in the consideration and discussion of advocated surgical technics, with less importance attributed to the "conservative attitude" and more insistence on "adequacy" of the technic to reach and eradicate the lesion. Finally, a sincere effort is evident to employ "the minimal amount" of surgical treatment to accomplish desirable ends, rather than to do routine surgical interventions and employ the same procedure in every case which presents itself, irrespective of its rationale.

The use of sulfanilamide in the treatment of otologic conditions, excluding meningeal infection and sinus thrombosis, is so recent that at this time a proper discussion and evaluation is impossible. Reports are only beginning to appear in the literature, and otologic clinicians are as yet unable to give specific reports and recommendations regarding the use of sulfanilamide in the treatment of suppurations involving various parts of the temporal bone. Only a meager experience with chemotherapy in cases of thrombosis of the lateral sinus has changed the entire views of Cody [2] on this topic. He cites Kemler [3] to the effect that the symptoms of septicemia before operation are completely controlled during the administration of sulfanilamide and for five to seven days after its use but that chills and fever then recur. For meningeal invasions and infections, the drug has given me, as well as others, excellent results, which, in my experience, are more prompt and effective when the focus in the temporal bone is eradicated promptly and efficiently by surgical intervention.

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2. Cody, C. C.: Thrombosis of the Lateral Sinus, Tr. Am. Laryng., Rhin. & Otol. Soc. **44**:362, 1938.

3. Kemler, J. I., in discussion on Ersner, M. S., and Myers, D.: Treatment of Thrombosis of the Lateral Sinus Without Ligation of the Internal Jugular Vein, J. A. M. A. **109**:923 (Sept. 18) 1937.

An article by Maybaum, Snyder and Coleman,[4] although it appears in the 1939 literature, deserves mention now, because it points out that the masking effects of the drug are such that better and sharper clinical acumen will be needed to evaluate the bedside picture in its relation to the necessity of intervening surgically. I believe that newer basic concepts regarding the interpretation of roentgenograms made *after* sulfanilamide has been given for some time will have to become general. Furthermore, a different formula comprising indications for surgical intervention needs popularization—all to the end that the patient shall come to the otologist and be treated by him before both the gravity of prognosis and the difficulty of diagnosis are increased.

ACUTE LESIONS

In the review of the literature last year (1937) attention was drawn to the work of Lüscher and Rotmann [5] on otomicroscopy of the tympanic cavity. Miodonski [6] confirms the observations of Lüscher, particularly as concerns the distribution of the capillaries in the tympanic membrane. Under the high power magnification available to him, he was able to determine that the ravinian fissure is not an opening at all, as is commonly believed, but is an atrophic area in the region of the pars flaccida. This may seem unimportant, but it has implications relative to the genesis of primary cholesteatoma and the finding of small cholesteatomas in this region without tympanic suppuration.

Magnoni [7] restudied the reparative processes of the membrana tympani, which had been worked out by Stinson.[8] He studied 10 cases. He was able to confirm the finding that the epidermis of the membrana tympani moves from the center of the drum toward its periphery near the external auditory canal. He did not find that this travel of the dermal layer of the drum goes on with the regularity of direction reported by Stinson, but in the main he confirms Stinson's observations. This substantiation is of value in estimating the prospects of healing and repair of a perforation in the membrana tympani and when better understood may influence the point of election to paracentesize the drumhead for acute suppuration.

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4. Maybaum, J. L.; Snyder, E. R., and Coleman, L. J.: The Value of Sulfanilamide in Otogenous Infections, with Special Reference to Its Masking Effect, J. A. M. A. **112**:2589 (June 24) 1939.

5. Lüscher, E., and Rotmann, S. S.: Typische otomikroscopische Befunde der Mittelohrtuberculose, Ztschr. f. Hals-, Nasen- u. Ohrenh. **39**:10, 1935.

6. Miodonski, J.: Beitrag zur Mikroscopie des Trommelfelles, Monatschr. f. Ohrenh. **71**:742, 1937.

7. Magnoni, A.: Osservazioni sulla migrazione dell'epitelio della membrana timpanica, Valsalva **14**:234, 1938.

8. Stinson, W. D.: Reparative Processes in the Membrana Tympani, Arch Otolaryng. **24**:600 (Nov.) 1936.

An interesting pathologic condition and one which is exceedingly rare is reported by Klister.[9] On otoscopic examination, a small mass was found occupying the area of the posterior sector of the drumhead, mostly lying in the superior quadrant. Under magnification this was made out to be a neoplastic growth, either an exostosis or an osteoma arising from the hammer handle. The condition caused no symptoms. There was no report as to whether acuity of hearing was lost. I suspect that there might have been such a loss. Klister's is the tenth such case reported in the literature.

In European otologic and pediatric literature, the controversy concerning otitis in infants and its relations to disturbances of nutrition is still being carried on unabated and without much prospect of being settled by generally acceptable concepts. Ten Bokkel Huinink [10] reports that of 1,130 infants observed by him, nutritional disturbances were present in 24 per cent, and diseases of the respiratory tract accounted for illness in 31 per cent. Of the latter group, 50 per cent had purulent otitis media, whereas in those with intestinal disorders only 20 per cent had otitis. The author advocates that antrotomy be performed in all cases in which pediatric therapy is not effective. He advocates surgical intervention in such cases even when it is impossible clinically to diagnose otitis media.

This report seems to epitomize the European opinion on the problem at present. In America there is a tendency to limit surgical intervention to cases in which pathologic changes are diagnosed or deduced from the otologic aspects. Tóbl,[11] in his study of 1,400 infections of the middle ear in infants and very young children, reports that only 97, or 7 per cent, required mastoidectomy. Of course, he bases his findings solely on the presence of demonstrable pathologic changes. I purposely avoid quoting and citing the many other reports in the literature of the year under scrutiny, because to do so would only be a reiteration of positions previously reported. Not since the publication of the work of Alden and Marriott and the fine Canadian study some years ago has anything of moment been added to the discussion of this topic. It seems desirable that some large pediatric clinic in this country should undertake another study of antrotomy for the relief of nutritional disturbances in infants, in an endeavor to determine the benefits obtainable.

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9. Klister, M.: A Case of Exostosis of the Hammer Handle, Arch. sovet. otol. **1**:33, 1938.

10. ten Bokkel Huinink, A.: Otitis in Infants and Nutritional Disturbances, Maandschr. v. kindergeneesk. **7**:91, 1937.

11. Tóbl, P.: Mittelohrentzündungen in Säuglings- und Kleinkinderalter, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **29**:32, 1937.

Last year I commented on tetanus as complicating otitic infection. Stout [12] reports 2 additional cases, which came under his observation. In both the condition was associated with acute purulent otitis media, the otitis preceding the appearance of the tetanus. Stout believes that these are probably cases of tetanus of the atrium.

Nunzi [13] observed 12 cases of diphtheria of the external and middle ear and the mastoid process. Reviewing the literature, he finds that characteristic symptoms of this specific infection, beyond the presence of the Klebs-Löffler bacillus, are not recorded. From an analysis of his own cases, he finds that diphtheritic otitis media purulenta makes its clinical appearance suddenly without any notable subjective symptoms. Paracentesis yields a serosanguineous fluid followed within a few days by a dirty gray secretion. The otoscopic picture is that of purulent otitis media. Removing the secretions, one observes shreds of detritus and pseudomembrane in the external auditory canal. When the patients come to operation on the mastoid process, extensive destruction of the mastoid cellular elements is found. The appearance of the field of operation resembles that in mastoiditis associated with scarlet fever. In addition to surgical intervention, therapy consists in intravenous and intramuscular administration of antitoxin and local tamponade of the wound with the same serum.

In dealing with the contagious diseases and the otitides which ensue, it is germane to note the comprehensive reports made by Horace Williams,[14] whose material has particular reference to otitides accompanying scarlet fever. The cases studied were collected between 1934 and 1937 from the Philadelphia Hospital for Contagious Diseases. Williams is of the opinion that scarlet fever produces more acute otitis media than does any other specific disease. The second source of origin is given by him as measles. In the period under survey, of 15,140 patients with scarlet fever, acute otitis media purulenta developed in 8.6 per cent. One third had bilateral involvement. Eight and three tenths per cent of the ears, belonging to 115 patients, required simple mastoidectomy, which was performed. The mortality among 115 patients was 10, or 8.7 per cent. Williams classifies the material into three groups: Group 1 comprised 1,049 ears on which myringotomy was performed before the membrana tympani ruptured. In group 2 there were 190 ears in which the membrana tympani ruptured spontaneously but nevertheless additional paracenteses were required. In

12. Stout, P. S.: Tetanus Associated with Acute Otitis Media: Probable Atrium Tetanus; Report of Two Cases, Laryngoscope **48**:682, 1938.

13. Nunzi, A.: Sulla differite dell'orechios, Ann. di laring., otol. **37**:172, 1937.

14. Williams, H. J.: Otitis Media and Orbital Cellulitis Complicating Scarlet Fever: Preliminary Report on Loss of Hearing from This Disease, Tr. Am. Laryng., Rhin. & Otol. Soc. **44**:134, 1938; Arch. Otolaryng. **29**:82 (Jan.) 1939.

group 3 Williams places 553 ears in which the membrana tympani ruptured spontaneously and further paracenteses were never required. In group 1, two incisions of the drum head were needed and done in 144 ears; three, in 32 ears; four in 13 ears, and five, in 3 ears. In group 2, there were 19 ears in which two incisions of the drum head were done, while 6 ears required three incisions. The incidence of mastoiditis requiring surgical intervention was 5.5 per cent in group 1, 13.2 per cent in group 2 and 5.8 per cent in group 3.

Williams states as his observation that early paracentesis did not lower the incidence of mastoiditis requiring surgical intervention. He nevertheless advocates it to relieve pain and reduce temperature and as the best means of avoiding mastoidectomy. I may remark here, in passing, that this opinion stands somewhat in contradiction to his conclusion based on his observed cases. Every otologic surgeon, when doing an early paracentesis, *hopes* by this means to avoid the development of mastoiditis requiring surgical intervention. But neither the numerous recorded experiences nor Williams' own observations present any substantial scientific data to support this hope. Too many factors other than the drainage of the tympanic cavity play a role in the development of mastoiditis requiring surgical intervention, factors which paracentesis, per se, cannot influence. Williams deduces, further, that repeated paracenteses have small value, provided the original incision into the tympanic membrane was adequate and that free drainage is established. With this point of view I am in full accord, and in these reviews I have repeatedly brought observations from the literature to substantiate it. Of 1,300 patients in Williams' study, 15.7 per cent had had the adenoids and tonsils removed. It is somewhat to be regretted that comparative studies of the tonsillectomized and the nontonsillectomized patients were not made in an endeavor to add data on the influence on otitis of the operations for the removal of tonsils and adenoids.

Finally, Williams reports on the work of Whoople and Cave, who examined the sinuses roentgenologically in 292 cases of scarlet fever. In 91 per cent pathologic shadows appeared. No ear evidenced purulent otitis media unless purulent sinusitis also was present. This observation may perhaps hold a key to preventive measures among patients with scarlet fever. The early search for infections of the paranasal sinuses might become a routine institutional procedure in hospitals for contagious diseases. If the findings of Whoople and Cave are substantiated, it seems that discovery and prompt elimination of lesions might be a means of lessening the incidence of otitis media purulenta among patients with scarlet fever. One other potent observation is cited from Whoople and Cave, namely, that the incidence of involvement of the paranasal sinuses

was not less in the tonsillectomized group than among those who had not had the tonsils and adenoids removed; in fact, it was proportionately greater.

One cannot leave so fine a study, embracing, as it evidently does, much painstaking observation and exact findings from repeated otologic examinations without expressing a slight disappointment that this large amount of material was not additionally submitted to observations which might throw light on fundamental questions which are still mooted. For example, what type of bony structure predominated among the patients who came to operation? In what proportion did chronic conditions develop and on what bony structure did these conditions seat themselves? What was the duration of the otitis relative to its early or late appearance in the course of scarlet fever? I record some of these questions here in the modest hope that Williams will continue this type of study and perhaps be induced to add them to his analyses in future reports.

Another report on the aural complications of scarlet fever comes from the Municipal Contagious Disease Hospital of Chicago. Hoyne and Spaeth [15] report on 3,564 cases of scarlet fever which were observed in one year—from July 1, 1934 to June 30, 1935. Of these, otitis media purulenta developed in 476, or 13.35 per cent, and of this number 124 required mastoidectomy. From Rumania Gheorghe [16] reports that during the epidemic of scarlet fever which occurred in 1936-1937 he observed 980 cases of scarlet fever in 116 of which acute otitis media purulenta occurred. Mastoiditis requiring surgical intervention developed in only 7 of these.

These reports assume larger import and significance because of the general popularity of sulfanilamide, the advocates of which contend that its use markedly lessens the incidence of otitic complications both from infections of the upper part of the respiratory tract and from those complicating the exanthemas. Likewise, it is generally alleged that the administration of sulfanilamide in cases of acute purulent otitis media has materially reduced the incidence of mastoiditis requiring surgical intervention. Study of the authoritative reports herein cited, with the small percentage of cases in which mastoidal complications requiring surgical intervention appeared before the advent of sulfanilamide, brings these contentions into serious question, and I am at a loss to find substantiation of Watson-Williams' [17] positive statement that sulfanilamide

15. Hoyne, A. L., and Spaeth, R.: The Ear Complications of Scarlet Fever, J. Pediat. **12**:287, 1938.

16. Gheorghe, I.: Mastoiditis in the Course of Scarlet Fever, Rev. romana de otolaryng. **4**:21, 1937.

17. Watson-Williams, E.: Sulfanilamide in Treatment, Bristol Med.-Chir. J. **54**:209, 1937.

is of definite value in the control of infections of the middle ear. He makes no case reports or other comparative studies to show on what he bases his contention.

Carey [18] treated acute purulent otitis media with adequate doses of sulfanilamide in 8 cases, yet surgical intervention was eventually required in 2. On the other hand, Livingston [19] states that 5 patients whose condition had been diagnosed as mastoiditis requiring surgical intervention and who according to the usual standards would have been submitted to operation recovered without operation with administration of sulfanilamide. Livingston, however, is more judicial in his attitude. He observes that it is well known that in some years the organisms infecting the respiratory tract in epidemics are much more virulent than in other years. With this view I am in accord. There is a distinct variation in the type, nature, severity and tendency to complications in different years and occasionally in different months of a given year. It may not be amiss to recall an earlier publication of Kopetzky and Hadjopoulos,[20] in which this variation was studied over six years. The report, concerned mostly with streptococcic infections, showed that they reveal orderly periodicity, with a suggestion that a major cycle embraces five to six years. In studying the effects of sulfanilamide as a hindrance to complications of purulent otitis media, this periodicity in the incidence of grave conditions must be given due consideration. My personal experience during 1937, before sulfanilamide was given in almost every case, shows that the number of patients coming into the hospital with the mastoid in a condition to require surgical intervention had fallen considerably. During the winter of 1938 and 1939, even though sulfanilamide was used much more frequently, the number of patients requiring mastoidectomy has increased.

Nevertheless, I quote from the study of Schenck,[21] who gives a comprehensive analysis of the use of sulfanilamide to date:

> In regard to otitis media the situation is too complex for satisfactory evaluation of the drug. . . . There is as yet no evidence that the drug prevents extension of the infection from the middle ear to the mastoid cells, although pediatricians in general feel that fewer mastoid infections followed infections of the middle ear when treatment with sulfanilamide was employed during the winter of 1937-1938.

18. Carey, B. W., Jr.: The Use of Para-Aminobenzenesulfonamide and Its Derivatives in the Treatment of Infections Due to the B-Streptococcus Hemolyticus, the Meningococcus, and the Gonococcus: Report of Thirty-Eight Cases, J. Pediat. **11**:202, 1937.

19. Livingston, G. S.: Sulfanilamide Therapy, Arch. Otolaryng. **27**:242 (Feb.) 1938.

20. Kopetzky, S. J., and Hadjopoulos, L. G.: The Relationship of Upper Respiratory and Alimentary Tract Flora to Mastoid Infections, with Special Reference to the Epidemiology of Mastoiditis, Laryngoscope **42**:661, 1932.

21. Schenck, H. P.: Use of Sulfanilamide in Otolaryngology: Review of the Literature, Arch. Otolaryng. **28**:698 (Nov.) 1938.

It has long been a common observation among otologists that grippal infections present a characteristic otoscopic picture and often a specific pathologic development not comparable to ordinary otitic infections. The otoscopic picture often shows blebs scattered over the surface, or dermal side, of the membrana tympani. Tobeck [22] in his study of grip-otitis states that the hemorrhagic blebs both in the canal and on the drum head are the result of toxic trauma to the capillaries. He holds that this condition precedes the onset of actual bacterial invasion of the spaces of the middle ear. He groups his findings under three headings: first, otitis externa grippalis; second, otitis media acuta grippalis, and, third, labyrinthitis serosa or purulenta grippalis. In this connection, the report of Ruskin [23] is important and interesting. On the basis of a study by Hess,[24] who was concerned with the frequency of grippal infections in persons with scurvy, Ruskin treated myringitis haemorrhagica bullosa grippalis with massive doses of a vitamin C product, using calcium cevitamate (ascorbate). He employed a 15 per cent solution of this drug, administering 3 cc. of it daily and sometimes more often. He proceeds on the theory that those subject to otitic grippal infections are in a stage of preclinical scurvy. His results are interesting. The pain in the ear disappears in all instances within twenty-four hours, and he reports his patients cured within four days. In view of my contention that the membrana tympani showing distinct blebs should not be incised and in view of Tobeck's study, this therapy may hold the answer in the given situation, for the most distressing symptom, otalgia, is relieved promptly. Whether Baer [25] had the same idea, I am unable to determine, because he says nothing of the preclinical stage of scurvy in grippal otitis. Nevertheless, he too reports good results after having used vitamin C in 15 cases of otitis media purulenta acuta.

For years the literature has reiterated reports of the specific clinical pictures in cases of infection with Streptococcus mucosus capsulatus: the meager signs of involvement of the middle ear, the insignificant mastoidal reactions and then the sudden flare-up, with the advent of grave intracranial complications. Later, the organism was identified as Pneumococcus type III, with a differing growth on culture mediums, showing on one hand a growth characteristic of the streptococci and on the other hand having pneumococcic features. This varying trend was evident also in the reactions of human tissue when the organism

22. Tobeck, A.: Die Grippeerkrankungen des Ohres, Med. Klin. **34**:349, 1938.

23. Ruskin, S. L.: Contribution to the Study of Grippe Otitis, Myringitis Bullosa Hemorrhagica, and Its Relationship to Latent Scurvy, Laryngoscope **48**: 327, 1938.

24. Hess, A. F.: Infantile Scurvy: Study of Pathogenesis, Am. J. Dis. Child. **14**:337 (Nov.) 1917.

25. Baer, M.: Otite moyenne et vitamine C, Rev. de laryng. **59**:165, 1938.

invaded the middle ear. According to Profant,[26] infection with Friedländer's bacillus in the mastoid process is similar in its effects to that with Str. mucosus capsulatus. Its most significant feature consists in the production of a sticky mucoid colony on culture mediums and likewise of a sticky mucoid reaction in the tissue involved. Profant cites an interesting case. He makes an important point in the "timing" of his surgical intervention at the end of the first week after myringotomy and three weeks after the onset of the meager symptoms of involvement of the middle ear. His judgment was substantiated by his operative findings, for, although the cortex and its underlying cell structures seemed firm and not markedly involved, nevertheless the deeper into the mastoid process he proceeded after he had removed them, the more evident the pathologic changes became. He was amazed to find the plate of the lateral sinus and the dural plate over the antrum and the mastoid entirely destroyed.

CHRONIC LESIONS OF THE MIDDLE EAR

In the older literature the danger of removing polyps from the middle ear was often stressed. Repeated warnings were given of the possibility of dural attachments of some polyps. From the trauma to the dura inherent in their removal, in the face of infection of the middle ear meningitis often subsequently developed. From observation of current practice some clinics where aural polyps are removed by snare with the patient under local anesthesia and the whole procedure considered "minor," I am impelled to record the presentation of Dannheimer,[27] who again recalls the dangers of depending entirely on otoscopic examination to diagnose the neoplasm, which is seen as "aural polyp," and proceeding forthwith to remove it. In a 53 year old patient, whose symptoms were gradual onset of paralysis of the facial nerve, vertigo, headache, vomiting and eventually hoarseness, ptosis and palsy of the abducens nerve, the affected ear showed only a polypoid growth in the middle ear. Necropsy indicated that the growth was a meningioma originating in the middle cranial fossa, which had extensively eroded the temporal bone. Thus not only the dangers to the dura from trauma but the very character of the so-called polyp is in question until its removal and examination. According to the old teaching of Dench and others, the spaces of the middle ear should be opened and the surgical removal undertaken with the same care and precautions as would be used for the removal of a neoplastic growth anywhere else in the body.

26. Profant, H. J.: Mastoiditis Caused by Friedlander's Bacillus, Tr. Am. Laryng., Rhin. & Otol. Soc. **44**:498, 1938.

27. Dannheimer, W.: Zur Kasuistik der Ohrpolypen, Hals-, Nasen- u. Ohrenarzt. **28**:343, 1937.

There is always interest in reports on cholesteatoma. This by-product of nature's effort to procure healing in chronic conditions has engaged the study of otologists for decades. The sequence of growth, the manner in which its mass takes shape, like an expanding neoplasm, its absorption of the bone on which it lodges by exerting mechanical pressure on it and the extent to which it may invade vital structures give each report an interesting aspect. Holmes [28] has performed a service in his review of 303 cases of cholesteatoma. He believes that "primary" cholesteatoma, with an intact drum head, is more frequent than most otologists think. By "primary" cholesteatoma is not meant "true" cholesteatoma. There are several reports of this lesion in this year's literature. The one by Friedman and Quittner [29] describes a patient whose illness commenced with paralysis of the facial nerve, spasmodic twitchings, impaired hearing and narrowing of the external auditory canal, without otorrhea or evidence of aural infection. The membrana tympani appeared normal. Roentgen examination revealed sclerosis of the right mastoid process and the suggestion of a cholesteatoma. At operation this lesion was found. The facial nerve, exposed to its encroachment to the extent of 1.5 mm., was dark brown. The patient recovered. Diamant [30] watched the development of a cholesteatoma behind an intact and microscopically unchanged membrana tympani. He concludes his study with the statement that perforations of the drum head in the region of the attic and the antrum are not necessarily the result of otitic suppuration but are due to the pressure on Shrapnell's membrane—positive on the side toward the canal and negative on the epitympanic side—causing an indrawing of this portion of the membrana tympani. Thus he substantiates observations of Wittmaack, who called the lesion primary pseudocholesteatoma. It must not be confused with true cholesteatoma, which is congenital. The pressure to which Diamant calls attention results from the production of hyperplasia of the mucosa which, by virtue of adhesions, completely shuts off this portion of the epitympanic space from the remainder of the middle ear. The air which remains in the enclosed space is absorbed by the blood in the capillaries; hence, the negative pressure. Such a condition may be present for years without interfering with the auditory function or causing the patient any annoyance. However, when a secondary infection sets in, true "choles-

28. Holmes, E. M.: A Review of Three Hundred and Three Cases of Cholesteatoma, Ann. Otol., Rhin. & Laryng. **47**:135, 1938.

29. Friedman, M.D., and Quittner, S. S.: Cholesteatoma Verum of the Right Mastoid, Arch. Otolaryng. **28**:209 (Aug.) 1938.

30. Diamant, M.: Acute or Chronic Otitis Media, Acta oto-laryng. **25**:507, 1937.

teatomeiterung" becomes evident. Both Laskiewicz [31] and Bernheimer [32] cite what they believe to be cases of primary cholesteatoma of the mastoid process. Reading their reports I question this contention. In Laskiewicz's case a 12 year old child suffered from otitis media purulenta which followed an attack of scarlet fever. Simple mastoidectomy was done. The wound healed, and after a time fever and all the symptoms of reinfection of the mastoid process appeared. At the second operation, a large cholesteatoma was found to occupy the cavity left by the first operation.

I cannot comprehend on what grounds Laskiewicz terms this congenital cholesteatoma, with his own record of purulency of the middle ear which followed scarlet fever. Acute necrotic otitis media is not uncommon, particularly after scarlet fever. Sometimes symptoms supervene in the course of this lesion which necessitate simple mastoidectomy. Subsequently the middle ear continues to discharge because the osseous rarefaction has not been reached by the technic of the simple mastoidectomy and remains in the hypotympanic and epitympanic spaces. Wittmaack and Almour [33] have also shown that the reparative processes in such cases consist of an ingrowth of epithelium from the external auditory canal in an endeavor to cure the chronic condition. In its ingrowth, the epithelium finds a large cavity artificially created by the surgical intervention on the mastoid process, which it readily lines. In encountering irregularities of surface and small bony obstructions, it is thrown on itself, and this, added to its characteristic desquamation, forms a pseudocholesteatoma in the cavity. In Bernheimer's case also there is doubt as to the cholesteatoma being a real primary one since surgical intervention preceded the development of the lesion. A patient, many years before coming under the author's observation, had a postauricular incision to remove a foreign body from the external auditory canal. When first seen by Bernheimer he had a granulating fistula on the posterior wall of the canal from which pus discharged. The membrana tympani and the middle ear appeared normal on otoscopic examination. At operation a large cholesteatoma of the mastoid process was found.

The surgical treatment and general management of chronic mastoiditis is on a rather set basis. Hastings [34] brings up a point on which comment may be allowed. Concerning the operative treatment of chronic mastoiditis, he recommends that in cases of central perforation

31. Laskiewicz, A.: Du cholestéatoma congénital, Rev. de laryng. **58**:281, 1937.

32. Bernheimer, L. B.: Primary Cholesteatoma of the Mastoid, Arch. Otolaryng. **27**:135 (Jan.) 1938.

33. Almour, R.: Significance of Squamous Epithelium in the Cause and Repair of Chronic Middle Ear Disease, Tr. Am. Acad. Ophth. **35**:357, 1930.

34. Hastings, S.: The Operative Treatment of Chronic Mastoid Disease, J. Laryng. & Otol. **53**:246, 1938.

in which the hearing is good and the chronic disease of short duration antrotomy (simple mastoidectomy) be performed. This is his operation of choice. When the lesion is of longer duration, a conservative radical operation is recommended. With marginal perforation and good hearing, Hastings prefers a modified radical, and in all other cases a radical, mastoidectomy. The use of the term "chronic mastoid disease" by Hastings is unhappy. It is not a pathologic diagnosis, and hence it is difficult to comprehend for what kind of lesion he is recommending a given procedure. Chronic otorrhea is a symptom common to many otitic lesions. Centrally located perforations are generally characteristic of suppurative lesions confined to the mucosa, are nondangerous and rarely require surgical intervention. The description of the types of lesion for which Hastings recommends his various operative technics would clarify the issue. A chronic aural discharge is too often the result of a specific lesion in the middle ear to have either diagnosis or surgical therapy based on the time that it has been present.

INFECTIONS OF THE BLOOD STREAM

I am indebted to the report made by Cody [2] before the Southern Section of the American Laryngological, Rhinological and Otological Society for drawing attention to the fiftieth anniversay of the first successful operation for thrombosis of the lateral sinus, by W. Arbuthnot Lane.[35] Lane's original report, as Cody points out, already presented the question whether one should ligate the internal jugular vein to get the best results. The question is still pending. Cody reviews the symptoms and the operative findings, discusses the Tobey-Ayer phenomenon as a diagnostic aid, draws attention to anatomic variations of the cranial sinuses and points out their clinical aspects. He lists four purposes accomplished by ligation of the jugular vein:

> First, as a preventive measure to impede the entrance of emboli into the lung as infarcts from the proximal end of the thrombus. . . . Second, as a protection against the possibility of a mural thrombus in the jugular bulb becoming an embolus. Third, to demark positively the limit of the proximal extension of the thrombus in the internal jugular vein and if the jugular be thrombosed to resect it. Fourth, as a secondary defense against bacteriaemia. The ligation of the jugular seems to be effective in those cases of thrombosis operated upon reasonably early; but in the advanced cases, chills occur frequently after ligation. . . . where the invading bacteria are quite virulent, ligation has little effect on the sepsis.

Cody's personal observations comprise 16 consecutive cases in which thrombosis of the lateral sinus occurred, among 518 mastoidectomies, or 3 per cent of his cases of mastoiditis requiring surgical intervention, with a mortality of 25 per cent. He finishes his report with a note on the

35. Lane, W. A.: Five Cases of Complicated Diseases of the Middle Ear, Tr. Clin. Soc. London **22**:255, 1889.

effect of sulfanilamide, to which I have alluded in the introductory paragraph of this article. Evans [36] in his survey of current opinions and records tabulates the result of a questionnaire regarding the incidence of the lesion. Only nineteen of the three hundred and forty-three replies received from otologists and institutions reported an incidence higher than 6 per cent. Evans comments on the finding that among those who reported to him higher incidences of occurrence were some of the outstanding specialists of the country. He observes that the figures from these surgeons do not give a true picture of the percentage of occurrence of sinus thrombosis but rather are the result of the larger number of referred patients coming to them for specific operative therapy, the thrombosis not actually occurring, in every case, in their individual practice. In making studies of the incidence of sinus thrombosis in the run of cases of mastoiditis requiring surgical intervention, thrombosis occurring in extramural practice should be separately considered. The surgeon should have reported only the cases in his own practice in which thrombosis developed from mastoiditis under his observation. The records which Evans' reviews deal with 59,850 cases of mastoidal infection. Among these, 1,556 cases of sinus thrombosis are noted. These figures yield an incidence of 2.6 per cent of thrombosis of the lateral sinus in mastoidal disease. Behrman [37] studied cases covering twenty-six years, between 1910 and 1936. There was a mortality of 32 per cent. In 65 per cent of the cases sinus thrombosis developed after acute purulent otitis media. The record is of 104 cases.

Sutherland [38] discussing otitic sinus thrombosis notes that the medical profession has not as yet become fully aware that otitic sepsis can have its focus in some other part of the vast venous network surrounding and penetrating the various portions of the temporal bone. This view is substantiated by Lillie,[39] who states in the introductory remarks of his monograph on surgery for sepsis of otitic origin "that in the extensive literature . . . the tendency has been to consider infections of the blood stream that are associated with infections of the temporal bone under the general term 'sinus thrombosis.'" I have for years taught and written in the same vein and am in full accord with both Lillie and Sutherland. The latter's comment that it is much more important to remove the primary focus in the bone itself for the cure of otitic sepsis

36. Evans, W. H.: Thrombosis of the Lateral Sinus: A Survey of Current Opinion and Records, Arch. Otolaryng. **28**:959 (Dec.) 1938.

37. Behrman, W.: The Sinus Thrombosis Material of the Sahlgren Hospital, 1910-1936, Acta oto-laryng. **25**:534, 1937.

38. Sutherland, J. M.: Otitic Sinus Thrombosis, Arch. Otolaryng. **27**:1 (Jan.) 1938.

39. Lillie, H. I.: Surgery of the Ear, New York, Thomas Nelson & Sons, 1938 chap. 9, p. 262.

than operatively to attack a definite portion of the venous system, because of the wide anastomosis of the veins around the temporal bone, also deserves attention. The plea for early surgical intervention made by Beck in reporting his cases of so-called "thrombotic mastoiditis" and in connection with the group of cases of sepsis which I have classified as instances of "hemorrhagic mastoiditis" falls into the same category. Sutherland particularly stresses the importance of the anomalies in the anatomy of the lateral sinus and of the sagittal and the petrosal veins and the petrosquamous sinus in infancy. He stands on firm ground in his recommendations as to therapy, namely, eradication and drainage of the primarily infected area.

As an aid to diagnosis, the Tobey-Ayer tests have in the main proved their worth, a few errors and failures to the contrary notwithstanding. Van Dishoeck [40] presents a test based on similar principles. When pressure is exerted on the internal jugular vein of one side, the turbinate tissue in the nose swells on the same side. This results from retrograde congestion of the pterygoid plexus with blood from the cranium. The test is performed as follows: An inflated finger cot is placed over a rubber cork through which a glass tube is passed. The protruding end of the glass tube is connected with a water manometer. The finger cot is inserted into the nostril and placed in apposition with the inferior turbinate body of the nose. The pressure is recorded. Manual pressure is then exerted over the internal jugular vein and the pressure again noted. When the condition in the lateral sinus is normal, a rise in pressure in the manometer is to be noted from impingement of the engorged turbinate against the finger cot. When a sinus thrombosis is present, there should be no perceptible increase in the pressure recorded by the nasoplethysmometer. The value of this test is still to be determined.

Juers,[41] evaluating symptoms in a study of 21 cases of otitic sepsis, with a mortality of 24 per cent, finds that he can show no relation between chills and bacteremia. He reports a positive blood culture in only 11 of his cases. His observation is that chills were more frequent among children than is generally supposed. He placed considerable stress on headache as a significant diagnostic sign. The failure to procure a positive blood culture in half of his cases deserves attention. The finding of a positive blood culture is proof of bacteremia. The negative finding, however, is not open to such a clearcut deduction. If the surgeon is absolutely sure that there has been no technical failure in

40. van Dishoeck, H. A. E.: Nasenplethysmometrie als Mittel zur Diagnose der Durchlässigkeit des Sinus sigmoideus und der Vena jugularis, Acta oto-laryng. **26**:45, 1938.

41. Juers, A. L.: Otitic Sepsis: Analysis of Twenty-One Cases and Anatomic Study, Arch. Otolaryng. **27**:178 (Feb.) 1938.

taking the blood for the culture, if no error has occurred in the preparation of the medium, its reactions or the temperature at which it is kept, if the bacteria drawn from the patient with the blood are of a type that will grow colonies on the medium and—finally—if the concomitant signs and symptoms warrant the assumption that bacteria are present, then the failure to get positive blood cultures in half of a series of cases is noteworthy. Otherwise, a negative finding from blood culture becomes only a matter to record, and one may yet deduce that bacteremia is present. On the question of a positive or a negative finding from blood culture a large amount of literature exists, and no purpose would be accomplished at this time by reopening it.

Years ago I was taught by Jonathan Wright, and I still believe it true today, that when chills and a septic temperature curve are presented bacteria are generally found in the blood stream, whether or not they can be demonstrated on artificial culture mediums. This is considered true particularly when other signs of bacterial infection occur, such as a progressive fall in the hemoglobin index and a progressive loss in the total red blood cell count. Such a deduction is especially likely to be correct when the pathogenic organism is of the hemophilic type. Scalori [42] reports a case of a child 9 years of age on whom simple mastoidectomy had been performed on the left. Forty days postoperatively follicular tonsillitis developed, accompanied by purulent otitis on the right. On the second day of this illness, paracentesis was done, yielding only a scant discharge of pus. Severe sepsis immediately set in, bringing death on the fourth day of illness. Autopsy showed the presence of thrombophlebitis of the right sigmoid sinus. Scalori believes that in this instance the route of infection was retrograde thrombosis. The autopsy report does not trace the regression from the middle ear to the lateral sinus, but in view of the studies of Hadjopoulos and Bell,[43] who traced infective bacteria through the lymphatics as well as through the blood stream, it seems that Scalori's opinion is substantiated. When discussing Hastings' paper and commenting on his report on chronic lesions of the nondangerous type which presented central perforations, I did not touch on superimposed infections in such cases, which are dangerous and change the character of the conditions. Thus Klicpera [44] reports on 7 cases in which sinus thrombosis occurred in the presence of chronic purulent otitis media with central perforations. In 6 of these, the acute flare-up followed bathing. In only 3 cases did the otoscopic

42. Scalori, G.: Tromboflebite otogena precocissima del seno laterale, Valsalva **13**:585, 1937.

43. Hadjopoulos, L. G., and Bell, J. W.: Direct Versus Intermediate Pathways in Infections of the Mastoid, Arch. Otolaryng. **25**:601 (June) 1937.

44. Klicpera, L.: Sinusthrombosen bei chronischer Mittelohreiterung mit zentraler Perforation, Monatschr. f. Ohrenh. **71**:1321, 1937.

picture give any evidence of the acute exacerbation, and in 1 the middle ear actually was dry. The bony structure in all these cases showed disturbance of pneumatization, and in all of them the infection followed the tissues by contiguity of structures, bridging the space between the antrum and the lateral sinus and passing through the chain of cellular structures and the lymph channels. Radical mastoidectomy was done in 2 instances and simple mastoidectomy in 5, besides surgical treatment of the lesion in the lateral sinus. Six of the patients recovered.

Behrman [37] finds no difference in the results of treatment with and without ligation of the jugular vein, while Atkinson [45] discusses treatment of infection of the lateral sinus without operation on the vein. He limits ligation or resection to cases of tenderness along the course of the jugular vein, enlarged glands in that region or repeated rigors after operation on the sinus. In 5 cases of sinus thrombosis he ligated the vein in 2, because the bulb or the vein itself was involved. In this, as in many publications, the stress in discussion of therapy is placed on ligation or nonligation of the internal jugular vein. Gill,[46] on the contrary, contends that the treatment of infections of the blood stream secondary to purulent diseases of the middle ear and the mastoid process is primarily medical and should consist of transfusions of immunized blood, administration of polyvalent antistreptococcus serum, intravenous injections of dextrose and sodium chloride and, lately, the administration of sulfanilamide.

LESIONS OF THE PETROUS PYRAMID

Many cases of suppuration of the petrous pyramid have been reported, mostly because of the increasing frequency with which the lesion is recognized clinically and operated on and the recovery or the death recorded. If the reports demonstrate nothing else, they are evidence of an increasing diagnostic acumen on the part of the general run of otologists. Among the leaders in this field of study, two strong trends are observable. In the first place, a diagnosis of petrosal suppuration per se is recognized as incomplete. The endeavor is to make a "diagnosis of localization," with the obvious corollary that surgical measures shall be devised to reach the locality diagnostically recognized as the seat of the lesion. The use of "standard procedures" for "petrositis" was evidently a passing phase in the development of both the diagnosis and the surgical treatment of petrosal suppurations. In the second place, the leading students of this condition are stressing the adoption of the

45. Atkinson, E. M.: Treatment of Lateral Sinus Infection Without Operation on the Jugular Vein, Arch. Otolaryng. **27**:169 (Feb.) 1938.

46. Gill, E. G.: Infection of the Blood Stream: Medical Treatment, with Special Reference to Transfusions of Immunized Blood; Report of Cases, Arch. Otolaryng. **27**:67 (Jan.) 1938.

"minimal" operation to accomplish results. Failure to effect cure with the "minimal" operation is followed by secondary operations more and more extensive, until cure results and a return to normal conditions is brought about. As a corollary of this second trend, outstanding students of petrosal suppuration, like Ramadier and Almour, to give but two examples, who are authors of specific technics for surgical intervention on the petrous pyramid, are advocating their own surgical procedures for use not in all cases but only after a diagnosis of localization has established that other and minimal procedures would fail to eradicate the lesion. In the specific reports that follow I shall substantiate these observations with citations. Finally, I believe the time has passed when reports can be accepted of cases in which operation has been done without serious effort to classify the symptoms arising from the petrosal lesion, from the accompanying extradural abscess and from the meningitis which is present at the time of operation.

During the year under review interesting cases were reported by Frotzel,[47] Luquin,[48] Guillon and Hery [49] and Akai.[50] The condition in each case was diagnosed as "petrositis" and adequately handled. In Bologna, Italy, a symposium on petrosal suppuration was held at the congress of otolaryngologists.[51] Bombelli [51] reported finding a fistula in the hypotympanum, which he widened by curetting it. A lateral pharyngeal abscess developed, which was opened through the pharynx, with counterdrainage behind the sternocleidomastoid muscle. Monte [51] reported a case in which diagnosis was not made during the patient's life but at autopsy bilateral osteomyelitis of the petrosa was discovered. I have referred in earlier summaries to reports similar to many in the French literature on osteomyelitis of the petrous pyramid among children and infants. Fioretti [51] reported 2 cases in which diagnosis was made and healing occurred spontaneously after radical mastoidectomy. The American literature has many statements of the frequency of spontaneous cure of petrosal infection but extensive case reports with detailed descriptions of the symptoms and their "sequence of abatement" as recovery takes place are mostly lacking. Calicetti [51] reported on 5 cases, with recovery in 2 and death in 3, while Giuffrida [51] reported spontaneous recovery in 1 case and death in 1. In the latter, the lesion

47. Frotzel, J.: Acute Otitis Media with Suppuration of the Cells in the Petrous Apex, Časop. lék. česk. **76**:1493, 1937.

48. Luquin, P. T.: Deep Seated Lesions of the Petrous Apex, An. Soc. mex. de oftal. y oto-rino-laryng. **11**:317, 1937.

49. Guillon, H., and Hery: Empyéme clos de la pointe petreuse: Operation de J. Ramadier; Guérison, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **30**:427, 1938.

50. Akai, M.: Two Cases of Petrositis, Otologia **10**:505, 1937.

51. Proceedings of the Congresso della Societa italiana di laringologia, otologia e rinologia, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **29**:298, 1937-1938.

in the middle ear healed after eight days. Apicitis and fatally terminating leptomeningitis developed three months later. Although the observer does not say so, the course seems to be the classic one of pneumococcic meningitis.

Statements by Calamida,[51] Giusani [51] and Ricci [51] about operative treatment also were reported. Calamida prefers the Ramadier operative procedure to all others, but Giusani and Ricci both take the modern standpoint and recommend successive stages of operation, namely, the "minimal" procedure followed by more extensive procedures until the lesion is eradicated. The most impressive statement along these lines comes from Ramadier,[52] one of the French pioneer workers in this field. He reports that the operative procedure should fit the site of the lesion in the petrosa and that stress should be laid on the diagnosis of the site of the lesion by the recognition of the area from which the pus arises, that is, the middle ear or the mastoid process. For posterior lesions which surround the labyrinth, atticoantrotomy (simple mastoidectomy) is indicated. For anterior lesions, he recommends either his own operation or that of Almour, provided that the labyrinth is alive. When a fistula is found, it should always be widened. He never uses a modified Streit operation, because he knows the danger of injuring the dura by such procedures. The extradural approach Ramadier reserves for cases in which evacuation of an extradural abscess is required. Finally, he finds that in certain cases apicectomy is needed. This is exactly the way I advocated handling petrosal suppuration in a brief case report.[53] In the second case reported in the same communication simple mastoidectomy was followed by watchful waiting; then radical mastoidectomy was performed, with drainage of an anterior fistula at the tubotympanic orifice; finally, after another interval of watchful waiting, apicectomy was performed to eradicate the lesion which was involving the meninges. My patient recovered. Two reports from Lund are available. In one [54] he describes his experience with deep osteitic suppuration of the temporal bone in 54 cases. Thirty-eight were cases of acute or subacute petrositis; in 13 the condition was termed chronic, and in 3 cholesteatoma occurred. In all, 89 foci in the petrous pyramid were encountered. Fifteen were located anteriorly and 74 posteriorly. Lund's operative procedures parallel Ramadier's and my own. He prefers to reoperate when it becomes necessary, awaiting the outcome from each procedure before extending the operative field. He

52. Ramadier, J. A.: Les indications operatoires dans les petrosities, Oto-rhino-laryng. internat. **21**:489, 1937.

53. Kopetzky, S. J.: Management and Treatment of Otogenic Meningitis, Ann. Otol., Rhin. & Laryng. **47**:117, 1938.

54. Lund, R.: Deep Suppurative Osteitis of the Temporal Bone, Hospitalstid. **80**:313, 1937.

contends, furthermore, that the extrapetrosal approach as an independent surgical intervention has been entirely supplemented by intervention from within the petrosa. Those who are familiar with many of my numerous contributions will comprehend that Lund's advocacy of surgical intervention within the limits of the pars petrosa, without opening the cranial cavity and exposing the dura except when extradural abscesses are sought, meets full support from me. Gusic [55] reports on 10 cases. In 1 the lesion healed spontaneously, myringotomy only having been performed. In 3 a cure was affected by simple mastoidectomy (antrotomy) only. In another radical mastoidectomy became necessary. In 5 the Frenckner or Ramadier technic was employed. When translabyrinthine cells are present Gusic prefers to operate according to the method of Frenckner; otherwise, he prefers Ramadier's method of approach. Ninger and Hybášek [56] report on 6 cases of petrositis, in 5 of which diagnosis was made by clinical and roentgenologic examinations and in 1 at operation. These authors, too, feel that one must not have any fixed idea when operating in a case of petrositis. They deprecate the employment of a "routine means of surgical approach." In 3 of their cases radical mastoidectomy, in 1 simple mastoidectomy and in 2 only modified radical operations were necessary. They express their belief that for anteriorly located lesions the "minimal" operation is radical, and for posteriorly situated lesions, simple, mastoidectomy. Of course, in connection with both these procedures, the necessary surgical intervention on the exposed petrosal area is performed. How much more logical and scientific are these procedures, based on location of the pathologic change, than was the vaunted "conservative" attitude versus the "radical" attitude, based on "wishful thinking," of recent years! Of Ninger's and Hybášek's cases, peripetrosal extension and extradural abscess followed the "minimal" procedure in 2, in which the patient died. In the other 4 cures resulted, all procedures being intrapetrosally performed. Kopetzky [57] summarizes his conception of the surgical treatment of the petrous pyramid by reporting on a series of cases. In 10 simple mastoidectomy and widening and drainage of posteriorly situated lesions effected a cure. In 25 radical mastoidectomy was required, with enlargement of fistulas in anteriorly situated lesions. In 8 the Almour technic was employed for apical enclosed empyema, in 3 apicectomy was required. The lesion was posterior petrositis in 10 and anterior petrositis in 21. The lesions showed differing numbers of

55. Gusic, B.: Ueber Pyramidenspitzelleneiterung mit und ohne Gradenigoschen Symptomkomplex, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **30**:155, 1938.

56. Ninger, F., and Hybášek, J.: Otogenic Petrositis, Sborn. lék. **39**:1, 1937.

57. Kopetzky, S. J.: Surgical Treatment of Various Types of Lesions in the Petrosal Pyramid, Surg., Gynec. & Obst. **66**:395, 1938.

fistulas; in 4 cases there were multiple fistulas. The apex was involved in 7 cases. Eleven patients had meningitis; of these, 4 died, and 7 recovered. In this report Kopetzky also cautions that one must suit the operative procedure to the individual case, and he characterizes the approach to the pyramidal structures from the pharynx and neck through noninfected areas as a "cadaver operation." Mangebeira-Albernaz [58] is another who does a "minimal" operative procedure first and then if no adequate beneficial response is obtained extends his surgical attack. He reports a case of petrositis in a 50 year old patient in which he first did antrotomy (simple mastoidectomy) and then, when symptoms remained unrelieved, proceeded to perform a Ramadier operation. The patient recovered. Tanaka and Hayashi [59] report 3 interesting cases wherein they also performed the least surgical intervention they believed necessary to reach the lesion. In a patient 41 years of age mastoiditis was complicated by petrositis and an extradural abscess. Simple mastoidectomy and evacuation were attempted. Meningitis ensued, and death resulted. In the second case, a 54 year old patient first complained of deafness. Simple mastoidectomy was done, to be followed in eight days by the clinical picture of petrositis. At operation a group of cells was found on the inner side of the posterior semicircular canal. The tract was eradicated, and a cure resulted in five weeks. The third case was that of a 17 year old student. Following coryza bilateral acute purulent otitis media developed, apparently healing within the next three months, during which time the surgeons performed repeated myringotomies. A month later symptoms reappeared referable to the right ear. The drum appeared pale and thickened, and the posterior superior wall of the canal drooped. Simple mastoidectomy was performed, and transient improvement was noted. Two months later symptoms of petrositis set in; fever developed, and further operation was undertaken. At the radical mastoidectomy a group of infected cells was found which ran behind and medially from the subcochlear area toward the tip.

For the past seven years Lindsay [60] has been conducting a routine study of the temporal bones of meningitic patients coming to autopsy. His report to the Chicago Laryngological and Otological Society on the histologic picture of one or both temporal bones in 28 cases of meningitis is a fine detailed study, which must be read in the original to be properly appreciated. It is extensively illustrated with photomicrographs, which clarify the text. In addition, he reports 11 cases in detail,

58. Mangabeira-Albernaz, P.: Petrositis with Gradenigo's Syndrome, An. de oto-rino-laring. d. Uruguay **7**:47, 1937.

59. Tanaka, H., and Hayashi, T.: Complications of Mucosusotitis: Petrositis, Otologia **2**:4, 1938.

60. Lindsay, J. R.: Suppuration in the Petrous Pyramid, Ann. Otol., Rhin. & Laryng. **47**:3, 1938.

from the clinical, the operative and—when death followed—the histologic point of view. Space prohibits me from reproducing the case histories, but a summation suffices. Eight patients died of meningitis. Three patients with petrositis recovered. In 5 of 7 cases, including those of patients clinically observed and cured, a fistula to the middle ear was not demonstrable. These cases illustrated that an abscess in the apex frequently cannot be reached from the mastoid process. Lindsay finds that the abscess in the apex is often closed and that rupture may take place in one of several directions. He states that in every case the infection reached the pyramid by way of the pneumatic spaces, producing an area of suppuration and abscess in the bone. Later there was rupture into the meninges. The bone marrow showed marked resistance to the infection. Diffuse fibrosis occurred in these spaces in most cases, affecting the gray and the red marrow alike. There was some osteogenesis adjacent to the suppurating focus; this Lindsay considers a reaction in the marrow, which is not true osteomyelitis but an evidence that adequate defense is created against infections and destruction by infections. In only 1 case did bilateral osteomyelitis occur as a terminal lesion.

From his basic studies and from his clinical experience Lindsay draws some pertinent conclusions. He stresses the value of roentgen findings as an aid to diagnosis. He holds that adoption of the safest means of procuring drainage from a closed abscess is a necessity. He remarks that it is evident from the histologic observations that no single operative procedure is suitable for all cases of petrositis and that it is necessary to adopt a systemic approach that will avoid overlooking any localized area of disease. The complete exenteration of the mastoid cells is the first essential, including a careful search for tracts that might lead into the petrosa and exposure of the dura of the middle and the posterior fossa. Referring to his cases 5, 6 and 7, he advocated the elevation of the dura beyond the arcuate eminence in the middle fossa. These procedures may fail to reach suppuration in the apex, and Lindsay's histologic findings and his clinical experience indicate that an apical abscess is most frequently not accessible from the mastoid. The presence of fistulas opening into the middle ear may allow spontaneous recovery or when found at operation may lead to the focus in the apex. Lindsay used a combination of the technics advocated by Eagleton, Ramadier, Kopetzky and Almour. Certain other extrapetrosal methods of surgical approach might be found suitable in a case of large erosions of the intracranial surface of the pyramid or of a break through the inferior surface. However, Lindsay states that there can be no question of the desirability of securing drainage from the suppurating focus in the pyramid before intracranial extension has taken place. When surgical intervention is delayed until rupture of the cortex takes place

meningitis may ensue. The intrapetrosal method of draining an abscess at the mouth of the eustachian tube was used by Lindsay in 4 cases with satisfactory results. With his contentions, I find myself in accord, with reservations regarding the exposure of the dura of the middle and the posterior fossa during the first step—the simple mastoidectomy. I would reserve the dural exposure for use in cases in which extradural accumulations of pus were suspected.

The discussion following the contribution of Lindsay brought a report from Hagens,[1] who found osteomyelitis of the petrous apex in 3 cases, while Galloway [1] also recommended that one should endeavor to make a diagnosis not of petrositis but of the part of the petrosa involved, thus facilitating the selection of the operative approach in the given case.

Lund [61] elucidates the significance of symptoms. He states that ocular and retrobulbar pain are more apt to point to osteomyelitis of the anterior supralabyrinthine cells, while pain in the neck and the deep muscles of the neck suggests involvement of the sublabyrinthine region. Palsy of the sixth nerve is not bound up solely with apicitis but can—as all otologists know—result from thrombosis of the superior or the inferior petrosal sinus or of the cavernous sinus. Attention should be paid to disturbances in taste for the localization of lesions in the petrosa. Anterior supralabyrinthine petrositis involves the anterior two thirds of the tongue, because of interference with the chorda tympani in its course through the facial canal, whereas sublabyrinthine lesions cause disturbances in taste in the posterior third of the tongue, due to involvement of the glossopharyngeal nerve. In anterior petrositis the lesion may encroach on the carotid plexus and result in pupillary changes. Lund makes the pertinent observation, "The triad of Gradenigo has finished its role and has been replaced by the minutiae of the various combinations of symptoms in the diagnosis." With this statement I am fully in accord. In the matter of differential diagnosis, Mayer [62] advances significant data. On the basis of his personal experience he states an important means of diagnostic differentiation between an extradural abscess over the tegmen tympani resulting from mastoiditis and one resulting from petrositis. The lesion in the first instance may present an intense headache, but it is not localized either intraorbitally or supraorbitally as in the second instance. Laskiewicz [63] makes an important diagnostic distinction between two forms of osteomyelitis of the temporal bone in infants. One is the type in which septic symptoms appear early,

61. Lund, R.: Petrositis, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **30**:208, 1938.

62. Mayer, O.: Die Pyramidenzelleneiterung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **42**:87, 1937.

63. Laskiewicz, A.: Sur l'ostéomyélite pétrosquamo-mastoïdienne chez les enfants, Rev. de laryng. **59**:342, 1938.

with swelling extending from the ear to the eyelids, adenitis in both the anterior and the posterior cervical region and often multiple thrombophlebitis and mastoiditis. The second type is osteomyelitis of the petrous apex which starts with headache. Mündnich [64] discusses the significance of trigeminal pain. In the early work on petrositis, great stress was laid on pain and its regional intensities. Later, alterations were recorded. In Mündnich's case mastoidectomy for subperiosteal abscess was done in 1933. One month later severe headache developed on the left. The mastoidectomy was revised without yielding any significant findings. For two years a postauricular fistula persisted and suppurated. During this interval there was no pain. The patient then suffered from an attack of grip and died of purulent leptomeningitis. The autopsy showed, besides the latter condition, a large extradural abscess in the middle cranial fossa. The histologic findings revealed complete coalescence of the entire petrous portion of the temporal bone, anterior to the superior semicircular canal. The gasserian ganglion was bathed in pus. Degeneration of some of the ganglion cells and nerve bundles also was demonstrable. Mündnich discusses three possible explanations for the absence of pain: 1. The damage noted in some of the axis cylinders might account for the loss of function. 2. Only the perception of pain may have been destroyed, while the other functions of the nerve remained normal. 3. The patient may have been so constituted that he could readily stand pain. The observer contributes the suggestion that other tests for involvement of the fifth nerve should be employed, and might prove useful, in the diagnosis of petrosal lesions, among which corneal reflexes and perception of cold and heat come into account. This suggestion parallels that of Lund, which has been cited. I may add that this case proves the danger of permitting a persistent postauricular fistula to discharge pus for two years without surgical intervention. The supervening influenzal infection had a ready path toward the cranium.

The routes of rupture of petrous lesions are discussed by Maspétiol.[65] Such ruptures may take place under the labyrinth, behind the styloid process and along the fossa and tract in which run the great vessels of the neck. When the extrapetrosal collections of pus manifest themselves as a pharyngeal abscess, he recommends opening by an incision along the anterior portion of the sternocleidomastoid muscle. A focus within the apex proper may rupture along the musculature of the soft palate; it may follow the eustachian tube and appear near the tubal orifice, or it

64. Mündnich, K.: Ueber Ursache und Bedeutung otogener Trigeminus Schmerzen, Arch. f. Ohrenh. **144**:259, 1938.

65. Maspétiol, R.: Contribution à l'études des suppurations exocraniennes d'origine otitique: Les abcès secondaires aux pétrosites, Ann. d'oto-laryng., 1937, p. 790.

can cause a swelling on the vault of the nasopharynx. Maspétiol mentions the possibility that extradural pus may find the way through one of the natural openings, like the foramen lacerum or the jugular foramen, and thus reach a point outside the skull. Of course, the knowledge of these possibilities is important, and such ruptures have all taken place at some time or another. What is more important, however, is that the lesion shall be diagnosed while it is still unruptured, while it is still intrapetrosal, and surgical intervention should be adapted to reach its site.

Kelemen [66] reported on 2 cases of severe otitis in which osteomyelitis of the petrous pyramid developed, in both of which autopsy was performed and the lesions histologically examined. Kelemen holds with Mayer that the infection never originates in the marrow spaces but always spreads to them from the air spaces. This observation finds support in that of Lindsay,[60] which has been cited, that the infection always spreads from the pneumatic spaces to the marrow, the latter always showing marked evidence of resisting the spread of the infection. The only contrary point of view that I have been able to find in this year's literature is in the report of Pallestrini,[67] who contributes a study of 5 cases, in 3 of which the patient recovered. On the bases of his pathologic study at autopsy in the other 2 cases, he concludes that the spongy bone marrow, which he believes exists at all ages, is easily infected.

Richter [68] reports on the autopsy in a case of apical empyema of the petrous pyramid in a 66 year old patient, who died of meningitis after an otitic infection which lasted five weeks. Extensive pneumatization of the pyramid was found, involving all the cells in the suppurative process. There were multiple extrapetrosal ruptures—two through the tegmen to the dura of the middle cranial fossa, one from the retrolabyrinth to the dura of the posterior fossa and one into the internal auditory meatus. Another interesting postmortem observation comes from the report of Yamakawa and Kawano [69] of the case of a 29 year old patient suffering from aural discharge for five days. The only other symptom was headache. Streptococcic meningitis developed, and death followed.

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66. Kelemen, G.: Osteomyelitis of the Petrous Pyramid, J. Laryng. & Otol. **53**:113, 1938.

67. Pallestrini, E.: Rilievi anatomopatologici sulle cosi dette petrositi, Valsalva **14**:213, 1939.

68. Richter, H.: Beiträge zur pathologischen Anatomie des Ohres: Mehrfache Spitzenempyeme des Felsenbeines mit mehrfachen Einbrüchen ins Schadelinnere, u. a. in den inneren Gehörgang, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **141**:334, 1937.

69. Yamakawa, K., and Kawano, N.: Early Rupture of an Apicitis, Otologia **10**:901, 1937.

At operation the mastoid process was found uninvolved. At autopsy both gross and microscopic studies revealed that the cells of the petrous tip were initially involved. This empyema of the tip eroded the bone and ruptured into the middle cranial fossa. I have always taught that petrosal suppuration was not a complication of mastoiditis but rather of purulent otitis media. These observers further substantiate this contention.

Cheridjian [70] reports on a case of petrositis in an infant of 7 months in whom bilateral purulent otitis media had developed. Mastoidectomy was done on one side. Death ensued, and at autopsy extensive pneumatization was observed, which reached the apex on both sides. All the cells were filled with pus, which also bathed the vestibular and cochlear branches of the eighth nerve. This nerve on histologic examination was seen to be edematous and hyperemic. The report is interesting, first, because of the extensive pneumatization, reaching to the tips, in so young a subject. I doubt the interpretation of the autopsy because of the second observation, namely, that all the spaces up to the tip were filled with pus. In view of this, unless a lining membrane was demonstrable coating the trabeculae, how was it possible to differentiate the air-containing spaces from those which normally would have contained marrow? In view of the purulent invasion of these spaces, I am inclined to doubt the finding of complete pneumatization of the petrous portion of the temporal bone in a 7 month old infant.

Moorhead [71] read a paper before the Eastern Section of the American Laryngological, Rhinological and Otological Society, which he subsequently published with a coauthor (Moorhead and Baker),[72] in which 30 consecutive cases of petrosal suppuration are given with considerable detail. Moorhead describes a slightly modified Eagleton technic, which he employed in all his cases. In 8 of the cases meningitis was present when the surgical intervention on the pars petrosa was undertaken. In 4 cases a preoperative diagnosis of petrosal involvement was not made. It would take me too far afield to discuss in detail each of the 30 cases comprising Moorhead's report. It suffices to recommend to the serious student a study of the original communication, to be read against the background of current otologic opinion. The paper takes on

70. Cheridjian, Z.: Comportement des voies cochléaires et vestibulaires périphériques dans une panpétrosite bilatérale chez un enfant de sept mois, Rev. d'oto-neuro-opht. **15**:666, 1937.

71. Moorhead, R. L.: Petrous Pyramid Suppuration: When and How to Operate (with a Report of Thirty Cases), Tr. Am. Laryng., Rhin. & Otol. Soc. **44**:254, 1938.

72. Moorhead, R. L., and Baker, J. P.: Suppuration of the Petrous Pyramid: When and How to Operate; Report of Thirty Cases, Arch. Otolaryng. **28**:497 (Oct.) 1938.

added importance because it received full support from Friesner [73] in the discussion which followed its presentation. The latter quoted numerous extracts from his own contributions in substantiation. Moorhead's report contains a polemic discussion of his symptomatology, contrasting his observation to what is recorded "in literature." He has not, however, separated the signs and symptoms in his cases which arose from meningitis from those which came from the petrosal lesion. It is well known among clinicians that once meningeal infection is established, the symptoms from this overshadow and dominate the clinical picture, so that the less intense signs from an intrapetrosal lesion are obscured. In most of Moorhead's cases rupture occurred before operation, and extradural collections of pus are frequently noted. The possibility of a spontaneous rupture of pus from the pyramid through the tubotympanic area is almost negatived, Friesner stating in substantiation that his own postmortem examination of 30 lesions of the petrosa gave this observation only once. Nevertheless, the numerous reports of competent observers who recorded many such findings years before petrosal lesions were recognized clinically cannot be negatived by one man's opinions, and even Moorhead reported 1 anterior labyrinthine lesion with spontaneous rupture into the pharynx while 1 of his autopsy reports would lead the reader to suspect the presence of another such lesion.

In many of his operations, Moorhead added puncture and withdrawal of fluid from the pontile cisterna. His rationale for this is not entirely clear, since in some cases of fully developed meningitis the cisterna was not tapped, while in others it was. It is to be regretted that a comparison of the bacterial content of the fluid drawn from the cisterna by puncture with that observed by lumbar puncture was not reported. It would have substantiated or failed to substantiate a contribution made by Eagleton, who contends that in many cases pathogenic bacteria may be obtained by cisternal puncture while the fluid withdrawn by lumbar puncture still remains clear.

Moorhead's paper contains also a strong plea for the avoidance of radical mastoidectomy in order to conserve the hearing, and his presentation contains many audiometric records to prove his point. During the further discussion of this paper Kopetzky [74] drew attention to the lack of parallelism between the hearing which remains after radical mastoidectomy for chronic suppurations of the middle ear, which generally are of long duration, and that after radical mastoidectomy for an acute lesion, of short duration. In the first instance, most of the loss of hearing takes place in the long years during which the chronic condition has existed, and only to a degree does the radical mastoidectomy further produce it.

73. Friesner, I., in discussion on Moorhead,[71] p. 289.

74. Kopetzky, S. J., in discussion on Moorhead,[71] p. 288.

If petrosal lesions can be handled successfully surgically, with conservation of hearing, every one will concede that an advance in surgical therapy had been achieved. Three factors must be considered when one evaluates this noteworthy endeavor.

1. It must not be forgotten that most of the competent students of the lesion under discussion are agreed that radical mastoidectomy is not necessary in many of the cases. Most of the postcochlear lesions can be reached without resorting to this operative technic. Thus the question of conserving hearing by avoidance of radical mastoidectomy is limited to cases in which the lesion can be reached adequately only by radical mastoidectomy as one step in the procedure.

2. Elevation of the dura is necessary to reach the lesions anterior to the labyrinth without entering the middle ear, and to do this, on the basis of conserving hearing, entails dangers, which add to the gravity of the condition. This factor has so often been stressed by me in these summaries and in other publications that I shall not repeat my remarks here. It suffices to recall Ramadier's contentions regarding this point, already cited, agreement with which will be found in the writings and opinions of most neural surgeons. In many of Moorhead's cases the added danger was absent, because the lesion had already ruptured extradurally and accumulations of pus were found at operation between the dura and the bone. Finally, Lindsay,[60] in case 9 of his report, did a radical mastoidectomy and evacuated pus from the apex of the pyramid by entering it between the cochlea and the internal carotid artery, and he reports an uneventful recovery with perception of a whisper at 2 feet (60 cm.). I realize that Lindsay's single case does not establish a scientific criterion, yet it brings evidence on the question of radical mastoidectomy and its effect on hearing when employed for an acute condition in which the middle ear has not been involved for too long a time.

3. By avoiding entering the middle ear, does Moorhead invariably reach the location of the lesion, and does he eradicate it? This becomes a serious question when one reads his clinical histories of the lesions which terminated fatally and also of that which spontaneously ruptured from the anterior labyrinthine area into the pharynx. The observation at autopsy of "extensive necrosis" of the pyramid suggests that a Ramadier operation or an apicectomy might have eradicated this necrosed osseous tissue, and such intervention would have necessitated radical mastoidectomy as a step in the procedure. Finally, elevating the dura and making a hole for drainage from above into the petrosa is not the surgical answer to all types of lesions in the petrosal pyramid, as even Moorhead's cases demonstrate.

Moorhead's report, besides citing 8 cases of patients with distinct meningitis, shows that 7 patients had extradural abscesses and 1 had a

rupture into the pharynx. In 12 cases, the pontile cisterna was punctured and cloudy fluid withdrawn. Moorhead reports 20 recoveries and 10 deaths. Of the 10 patients who died he obtained permission for autopsy on 2. The autopsy records do not contain histologic observations. The statement is made that drainage of the pyramid was adequate. Nevertheless in case 3, the autopsy report notes "extensive necrosis" of the pyramid. The other autopsy, in case 9, gives no evidence as to the petrosal disease.

In view of the divergence present here, I am reminded of a pertinent observation credited to Balance,[75] who said,

> Want of agreement among serious workers about a grave question of surgical treatment arises from the lumping together of clinical conditions having an essentially different pathological basis, or from essential pathological conditions not clearly understood. . . . All true and lasting surgical practice is based upon pathology, and when once pathology of an affection is clearly appreciated, divergence of views as to treatment ought to disappear.

In the study of petrositis, so much stress has been laid on the disease produced by streptococcic and pneumococcic infections that invasions by specific organisms and by tumors are forgotten. Kleinfield and Smith[76] report the case of a 3 year old child who had symptoms referable to the ear but no objective otoscopic signs. One month subsequent to the appearance of symptoms, a large perforation of the drum appeared, and paralysis of the facial nerve developed. Radical mastoidectomy was performed. Although all tests for tuberculosis were negative, a tuberculous lesion was discovered post mortem.

Because roentgen examination is so important an aid to the diagnosis of petrosal lesions, it is germane to this summary to comment on this phase of diagnosis. Diagnosis should not be made on roentgenograms alone. With clinical symptoms to substantiate them, roentgen studies are invaluable in dealing with suppurative lesions. Because cases are being observed in which suppuration is absent, I have thought it advantageous to present a quotation from the contribution of Kraus,[77] according to whom a number of extrapetrosal processes attack the petrosa which in their commencement have meager otologic symptoms. He makes the following summation:

> 1. Destruction of the pyramid by malignant tumor of the epipharynx takes place from below, and roentgen examination reveals basal destruction first.

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75. Balance, C., cited by Lillie, H. I.: Surgery of the Ear, New York, Thomas Nelson & Sons, 1938, chap. 9, p. 262.

76. Kleinfield, L., and Smith, G.: Tuberculosis of the Petrous Pyramid, Ann. Otol., Rhin. & Laryng. **47**:261, 1938.

77. Kraus, L.: Pyramidal Changes in the Roentgenograms, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **142**:15, 1936.

2. The median parts of the petrosa are destroyed earliest and most completely, and because of this the roentgenogram often reveals steplike destruction.

3. The anterior surface of the pyramid and the adjoining bones are destroyed much earlier than the posterior portion, particularly than the cortical portion of the posterior wall, which resists the longest.

4. The first three points are readily explained by the position of the primary tumor and by the tendency of its growth.

5. If the posterior pyramidal surface is intact, roentgen examination reveals a relatively clear outline of the apex, even if rather large portions of the anterior part of the pyramid are missing.

6. If the posterior part of the cortex and the adjoining bone are completely or partly lacking, the roentgenograms show a complete defect of the petrosa or circumscribed lighter areas. If the defect is localized around the porus acusticus internus, this process is dilated.

7. A lighter area in the central part of the apex in a case of malignant nasopharyngeal tumor may be the result of an inward growing of the tumor along the tube and its bony surroundings. An inflammatory peritubal process may thus be recognized by a lighter area in the center of the roentgenogram.

8. Atrophy of the entire petrosa may be caused by severe medullary changes in the forms of active or passive hyperemia or by fibrous transformation of the marrow. . . .

9. The temporary absence and the reappearance of the apex in the roentgenograms can be explained by the changing calcium content. The change in calcium content, too, is probably caused by active and passive hyperemia. This fact probably applies to inflammatory processes as well as to those that are accompanied by stasis.

71 East Eightieth Street.

News and Comment

CASSELBERRY FUND AWARD

A sufficient sum having accrued from the Casselberry fund for encouraging advancement in the art and science of laryngology and rhinology is now available, in part or as a whole, for a prize award or decoration or to defray the expense of original investigation or research in the domains mentioned.

Theses or reports of work must be in the hands of the secretary of the American Laryngological Association, Dr. Charles J. Imperatori, 108 East Thirty-Eighth Street, New York, before Feb. 1, 1940.

GENERAL NEWS

Examinations for Certification by the American Board of Ophthalmology.—One written examination only will be given during 1940 for certification by the American Board of Ophthalmology. This will be held on March 2 in various cities throughout the country, and applications must be filed before January 1. Applicants must pass this written examination satisfactorily before being admitted to oral examination. The first oral examination will be given in New York on June 8 and 10. Candidates who are planning to take this oral examination must file case reports before March 1. The date of an oral examination to be held in the fall will be announced later.

Application blanks may be procured from the secretary-treasurer, Dr. John Green, 6830 Waterman Avenue, St. Louis.

CORRECTION

Through inadvertence, mention was not made in the article by Dr. Jacob Ruchman entitled "Rhinosporidiosis (Seeber): First Occurrence in a Female in North America," which appeared in the August issue (ARCH. OTOLARYNG. **30**:239, 1939), of the fact that figures 1 and 2 appearing therein were taken from the article by Drs. J. G. Pasternack and C. S. Alexander entitled "Rhinosporidium Seeberi: An Etiologic Agent in the Production of Nasal Polyps," in the June 1938 issue (ARCH. OTOLARYNG. **27**:746, 1938).

Abstracts from Current Literature

Ear

THE INFLUENCE OF BLOCK ANESTHESIA INDUCED BY PROCAINE HYDROCHLORIDE ON THE DEVELOPMENT OF OTITIS AND ACUTE MASTOIDITIS. A. J. BONDARIENKO, Rev. de laryng. **59**:836 (Nov.) 1938.

The author reasons that part of the disturbance in disease of the middle ear and mastoid is due to a neurotrophic influence. This is suggested by Wichnewsky, who treated otitis externa by injecting cocaine. The technic recommended is the injection of 8 to 15 cc. of 0.25 per cent procaine hydrochloride over the mastoid process or in the preauricular region. At intervals of about four to six days this may be done a second and a third time. In a series of 103 cases the author had especially favorable results with catarrhal conditions and less favorable results with suppurative conditions. When the suppuration had gone on to destruction of bone the results were not favorable. In some of the cases the injection was followed by a reduction in the leukocyte count. The procedure is recommended as a conservative treatment of inflammatory processes of the ear, but it is not intended to supplant other curative methods used in these diseases.

BATSON, Philadelphia.

DESTRUCTION OF FUNCTION OF THE INTERNAL EAR IN SCARLATINAL OTITIS. E. URBANTSCHITSCH, Monatschr. f. Ohrenh. **73**:1 (Jan.) 1939.

The loss of function of the internal ear in cases of scarlet fever is usually produced by serous labyrinthitis, even when there is severe suppuration in the pneumatic cells around the internal ear. When the condition is mild, repair of the function of the internal ear may be expected even when the patient is entirely deaf. In a large majority of cases of severe involvement, however, the normal function of the internal ear will not return. Particularly is this true when the patient has acute otitis media prior to the appearance of the exanthem and when otitis occurs soon after the appearance of the exanthem and the patient is in danger so far as the labyrinthitis is concerned. The fact that in scarlatinal otitis labyrinthitis is usually serous and seldom becomes purulent may be explained by the development of the scarlatinal antivirus within the body, producing greater resistance against the local suppuration. The author presents 4 cases and three photomicrographs accompany the article.

LEDERER, Chicago.

THE JUSTIFICATION OF WILDE'S INCISION. B. SCHMIDT and P. NASSUPHIS, Monatschr. f. Ohrenh. **73**:24 (Jan.) 1939.

In acute otitis media of infants a swelling behind the ear may appear in the first few days or in the third to the fourth week. In the former case the infiltration penetrates along the connective tissue within the squamomastoid or the tympanomastoid suture into the subperiosteal space, and the simple incision suggested by Wilde is sufficient to empty the superiosteal abscess. In the latter case there is actual destruction of the lateral wall of the antrum, and antrotomy is indicated.

LEDERER, Chicago.

SEVERE INJURY TO THE REGION OF THE MASTOID. F. X. KOCH, Monatschr. f. Ohrenh. **73**:66 (Jan.) 1939.

A girl 8 years old received a severe fracture in the region of the left mastoid process. A radical operation on the middle ear was performed, with wide exposure of the dura. An uneventful recovery followed.

LEDERER, Chicago.

A New Conception of the Defect in Hearing in Otosclerosis and Perhaps a New Method of Treatment. Max Meyer, Acta oto-laryng. **27**:1, 1939.

Meyer presents 6 cases of noninfectious progressive deafness, including 4 of typical otosclerosis, in which the patients were treated by a single puncture of the cisterna, by which 30 to 50 cc. of cerebrospinal fluid was removed. If this much fluid did not flow naturally from the needle it was removed by a syringe.

A favorable influence on the hearing and on the tinnitus was experienced in every case. Scientifically interesting is the fact that a simple reduction of fluid tension in the internal ear improved the hearing and favorably influenced the subjective noises. The author thinks that these experiments are of theoretic interest also in demonstrating that the conduction deafness of otosclerotic patients is not caused solely by ankylosis of the stapes.

The procedure is of therepeutic interest because the hearing in the majority of the cases was considerably improved, sometimes even becoming normal, and because the improvement did not immediately recede. Whether the improvement will last long enough to be worth while only time will tell, because only six months had elapsed since the treatment in his first case. Therefore, the longest period of improved hearing among his cases was six months.

His studies further show that the lowering of the upper tone limit for air conduction is no certain sign of atrophy of the labryinth, for in that condition the upper tone limit for bone conduction, as tested by means of the monochord, is often normal.

It is the author's belief that the deafness in these cases was due not so much to fixation of the stapes as to "hydrops labyrinthi." Grove, Milwaukee.

Larynx

The Indications for and Technic of Total Laryngectomy. Laclau-Lacrouts, Rev. de laryng. **59**:913 (Dec.) 1938.

This is a report on 24 patients operated on between 1935 and 1938 by the technic of Prof. G. Portmann. Of these 24 patients 3 are here reported on for the first time. The advantages of the low preliminary tracheotomy are pointed out, as well as the special procedures used in the closure of the pharynx. There are a description of the operative findings in the various cases and a detailed summarizing table. In September 1938 19 patients were living, 13 apparently well.

Batson, Philadelphia.

Branch of the Superior Laryngeal Nerve and the Function of the Cricothyroid Muscle. G. E. Jannulis, Monatschr. f. Ohrenh. **73**:64 (Jan.) 1939.

Occasionally after puberty the voice does not become lower, but the puerile voice persists, supposedly because of an inverted action of the cricothyroideus muscle. The author, therefore, paralyzes this muscle by the injection of procaine hydrochloride into the superior laryngeal nerve. The patient becomes accustomed to speaking with a natural voice, which he continues to use even when the analgesia of the nerve has disappeared. The author also succeeded, by the same method, in influencing the voices of castrated persons. Lederer, Chicago.

Pharynx

Dermographia in Patients with Adenoids. C. Calabresi, Arch. ital. di otol. **51**:94 (Feb.) 1939.

Previous studies of dermographia have led to false deductions, because the methods of investigation have been inaccurate. Contrary to previous opinions, Calabresi regards this reaction as a physiologic phenomenon. Recent investigations

tend to place dermographic reactions in the field of the neuroendocrine and the neurovegetative system, the index of sympathetic excitability being vasoconstriction, and of parasympathetic excitability, vasodilatation. Symptoms of functional alterations in the neurovegetative system in children with adenoids led Calabresi to examine the dermographic reflex in such patients. Using Comel's apparatus, by which the pressure is accurately determined, he examined 114 subjects. The results of the examination were not conclusive, since in normal controls he found great variations in the reaction. The most that can be said is that a certain lability of the neurovegetative system existed in the subjects studied.

DENNIS, San Diego, Calif.

PULMONARY COMPLICATIONS FOLLOWING TONSILLECTOMY. Z. SZOLNOKY, Monatschr. f. Ohrenh. **73**:48 (Jan.) 1939.

The author has observed the following pulmonary complications after tonsillectomy: 1. Bronchitis. Among 100 patients, only 4 had normal temperature after tonsillectomy; the remainder had a fever for six to eight days, the temperature rising to 100.4 F. This rise of temperature is explained by the author as postoperative bronchitis. (Unfortunately he does not describe his technic of tonsillectomy. It would be of interest to know something about that, since his finding that patients have fever for six to eight days after the operation is not in agreement with the usual experience.) 2. Pneumonia. Among 3,000 cases, the author observed bronchopneumonia in 12. 3. Abscess and gangrene of the lung. This complication took place in 2 cases only. Both patients had the operation under local anesthesia and were adults.

In order to study the pathogenesis of the pulmonary abscess, the author performed the following experiments: After the surgical removal of the tonsil, he dropped 3 cc. of iodized poppyseed oil into the fossa. After two minutes, he observed the radiopaque area within the bronchi by means of a fluoroscope. He draws the conclusion from these experiments that the pulmonary abscess develops by aspiration of infectious material from the mouth into the lungs and is not produced by emboli within the blood vessels of the lungs.

LEDERER, Chicago.

THE TREATMENT OF PAINS FOLLOWING TONSILLECTOMY WITH VITAMINS B_1 AND C. M. BAER, Monatschr. f. Ohrenh. **73**:58 (Jan.) 1939.

The pains following tonsillectomy are due to the wound within the mouth. Therefore, morphine, particularly as a suppository, should be administered. The pains, which sometimes are late complaints after the operation, are combined with some disturbances in the vitamin balance. In such cases the administration of vitamins B_1 and C seems to be the suitable treatment.

LEDERER, Chicago.

THE DIAGNOSIS OF LEUKEMIC DISEASE OF THE PHARYNGEAL ORGANS. RUDOLF LAUB, Pract. oto-rhino-laryng. **2**:23 (Feb.) 1939.

The author reports 2 cases of lymphatic leukemia, in 1 following a peritonsillar abscess and in the other the extraction of a tooth, with a secondary tumor-like swelling resembling a malignant tumor at the base of the tongue.

In both cases the condition was extremely virulent, rapidly progressive and fatal. The clinical findings were not apparent early. The diagnosis was not made until after examinations of the blood revealed the leukemic state.

The author stresses the importance of the association of disease in the pharyngeal organs, which may be the etiologic factor in a leukemic disease.

PERSKY, Philadelphia.

Nose

EPHEDRINE IN A PHYSIOLOGIC VEHICLE AND LATERAL HEAD-LOW POSTURE IN TREATMENT OF THE NOSE AND SINUSES. SIDNEY N. PARKINSON, J. A. M. A. **112**:204 (Jan. 21) 1939.

Parkinson describes a simple technic for the treatment of infection of the nasal sinuses. It consists of the use of a certain posture of the head and the instillation of a drug in a physiologic vehicle. Adequate aeration and free drainage follow, with a minimum of trauma, chemical and/or physical.

The technic is as follows: Preliminary shrinkage is first obtained by the use of an atomizer containing an isotonic solution of ephedrine. After five to ten minutes of waiting, the patient is placed in the lateral head-low posture, at which time ephedrine in Locke's solution or its equivalent is instilled into both nasal chambers, the two sides being treated simultaneously. Infants and small children can be held over one's lap. The posture is held for from three to five minutes. All the sinal ostiums of both sides are flooded by the solution. The head is then rotated to a face down position to permit the nasal contents to escape from the nostrils.

This technic is easy, practical and comfortable, with few if any untoward effects, and can be performed anywhere, for no special apparatus is necessary.

GORDON, Philadelphia.

OBSCURE LOW GRADE CHRONIC INFECTIONS OF THE ETHMOID SINUSES: USE OF THE PROETZ DISPLACEMENT SUCTION FOR DIAGNOSIS. GEORGE E. SHAMBAUGH JR., J. A. M. A. **112**:1226 (April 1) 1939.

The author discusses the problem of low grade chronic infection of the ethmoid sinuses. He points out some of the difficulties encountered when an accurate diagnosis of this condition is sought. The displacement method of Proetz is said to have placed the diagnosis of low grade infection of the ethmoid sinuses on a new plane of accuracy, and the author developed a technic on the same principle for appraising the ethmoid sinuses more accurately. The procedure is as follows: After the nose and nasopharynx have been cleaned of any adherent secretions, the patient's head is hyperextended in the Proetz position, and 0.25 per cent ephedrine in physiologic solution of sodium chloride is instilled into both nasal passages. Alternate suction and release of suction are applied from four to six times in each nostril and a search made for frank mucopus recovered. Recovery of mucopus indicates suppuration of the ethmoid sinuses, regardless of a normal intranasal picture or what the roentgenogram may have disclosed otherwise.

Fifteen cases, divided into five groups according to symptoms, are briefly cited. The symptoms in each group are as follows: (1) pain and headache, (2) infection in a remote organ, (3) chronic and persistent cough, (4) frequent head colds and (5) fever of unexplained origin.

The conclusions are as follows: "1. The displacement method of promoting drainage from the ethmoid cells will establish a diagnosis in many cases of chronic low grade ethmoid suppuration that would otherwise be doubtful or missed entirely. 2. Displacement suction will clear up many but not all chronic ethmoid suppurations. 3. Chronic suppuration of the ethmoid sinuses may exist with slight or obscure local symptoms, the presenting symptom being headache of obscure etiology, systemic infection such as arthritis, iritis or neuritis, chronic cough, frequent head colds or fever of unknown origin."

GORDON, Philadelphia.

THE PRESENCE OF KOCH'S BACILLUS IN THE NASAL MUCOSA. V. SANGIOVANNI, Arch. ital. di otol. **51**:57 (Feb.) 1939.

Investigations have revealed that in a percentage of normal persons the nasal and nasopharyngeal secretions contain tubercle bacilli. The percentage of secretions containing the organisms in persons with pulmonary tuberculosis is, of course, greater. The bacillus may reach the pituitary membrane from the

exterior, through the blood stream and by way of the lymphatic vessels. Implantation from the outside occurs from inhalation of infected dust, from the use of dirty fingers or handkerchiefs or from the projection of sputum above the soft palate during coughing in cases of advanced tuberculosis. Endogenous infection occurs in cases of extensive pulmonary tuberculosis as a terminal phenomenon, via the blood and lymph streams. The problem of penetration of the mucosa by the tubercle bacillus is obscure, but it is known that the pituitary membrane offers much resistance to infection. The presence of tubercle bacilli in the subepithelial tissue without clinical evidence of tuberculosis constitutes potential nasal tuberculosis.

Sangiovanni's investigations were made on 30 patients with open pulmonary tuberculosis with positive findings in the sputum, 30 patients with pulmonary tuberculosis with negative findings in the sputum and 20 normal persons. None had evident lesions of nasal tuberculosis. Secretions and scrapings from the mucosa were examined. In the first group Koch's bacillus was found in the nasal secretion in 26 per cent and in the scrapings in 20 per cent. In the second group the percentages were 6 in the nasal secretions and 16 in the scrapings. In the group of normal persons an occasional bacillus was found in only 1. The differences in the percentages for patients with closed pulmonary tuberculosis and for normal persons are explained by the assumption that the pulmonary infection had diminished the normal resistance of the pituitary membrane. DENNIS, San Diego, Calif.

OSTEODYSTROPHIA FIBROSA OF THE FACIAL BONES. K. HELLMANN, Monatschr. f. Ohrenh. **73**:40 (Jan.) 1939.

The author describes 4 cases of osteodystrophia fibrosa of the facial bones, but no illustrations accompany the article.

CASE 1.—A boy of 16 had a swelling in the left cheek. Roentgen examination revealed a tumor within the left maxillary sinus. The tumor had grown together with the floor of the orbit. A Caldwell-Luc operation was performed, with recovery.

CASE 2.—A youth of 18 had a thickening of the right frontal bone and the right superior maxilla. Roentgen examination showed that the right frontal and the right maxillary sinus were filled with a sclerotic bony tumor. Parts of the tumor were removed.

CASE 3.—A woman of 21 had a tumor as big as the head of a child in the region of the cheek. At operation a big cyst was found, displacing the maxillary sinus and the ethmoid bone.

CASE 4.—The patient had a swelling as big as an apple in the left cheek. At operation a tumor was found, containing many cysts. LEDERER, Chicago.

PLASTIC OPERATION WITH IMPLANTATION OF BONE AFTER OPERATION ON THE FRONTAL SINUS. P. REHAK, Monatschr. f. Ohrenh. **73**:45 (Jan.) 1939.

The history of a patient of 18 who had an operation on the frontal sinus after the method of Riedel is reported. After operation a deeply retracted scar developed. The scar was excised, and a plate of macerated bone of an ox was implanted. Three months after the operation the implanted bone was still in place.

LEDERER, Chicago.

Miscellaneous

ACUTE ANTERIOR POLIOMYELITIS FOLLOWING TONSILLECTOMY AND ADENOIDECTOMY, WITH SPECIAL REFERENCE TO THE BULBAR FORM. R. C. ELEY and C. G. FLAKE, J. Pediat. **13**:63 (July) 1938.

Reports of the bulbar form of acute anterior poliomyelitis following tonsillectomy and adenoidectomy have suggested that the procedure may in some manner

influence the entrance of the virus. A study of 418 consecutive patients with acute poliomyelitis adds further evidence of this possibility and strongly suggests that when the operation is elective it may be advisable to postpone it if poliomyelitis is prevalent. Eley and Flake offer the following information in support of this statement: Of 287 patients with spinal poliomyelitis, there were only 8 with a history of recent tonsillectomy and adenoidectomy. Of the 8 patients, only 3 acquired the disease between the seventh and the eighteenth day (the commonly accepted period of incubation of poliomyelitis) after the operative procedure. Of 131 patients with bulbar poliomyelitis, 17 had had the operation within twenty days prior to the onset of the illness. Fifteen of the 17 patients acquired the disease within the usual period of incubation. Statistical computations demonstrate that the occurrence of this number of cases within the given period cannot be attributed to chance or to the usual frequency of poliomyelitis. The clinical observations suggest that if the patient is harboring the virus at the time of the operation, traumatization of the tissues may enable it to gain entrance to the central nervous system by way of the lymphatic system or the blood stream or perhaps by direct neural extension. The fact that 1 of the patients acquired bulbar poliomyelitis after adenoidectomy without tonsillectomy indicates that it is not necessarily the latter operation which enables the virus to gain entrance to the central nervous system.

J. A. M. A.

NASAL CHANGES OBSERVED IN WORKERS IN CHROMIUM. GIORGIO MANCIOLI, Arch. ital. di otol. **51**:24 (Jan.) 1939.

This study is based on observation of 294 workers in chromium, of whom 34.93 per cent had ulceration of the septum and 21.57 per cent septal perforation. In recent years the wide use of chromium and its salts in industry has resulted in a large number of cases of poisoning. The respiratory tract is the pathway of entrance for the chromium vapor. The nasal changes are chiefly on the septum (Valsalva's area) and the head of the inferior turbinate. The other parts of the upper respiratory tract show inflammatory changes, and, in addition, systemic effects, chiefly degenerative changes in the liver and kidneys, are present. The nasal mucosa is covered with greenish crusts. During the period of ulceration the symptoms are meager: headache, especially in the evening, and slight burning in the nasal fossae. Some persons have a special sensitiveness to chromium, but usually the disturbances depend on the length of time the worker is exposed and on the sufficiency of ventilation and the adequacy of the precautions surrounding him. The location of the lesions is related to the course of the currents of the inspired vapor in the nose and to the fact that the nasal septum is lacking in mucous glands and is furnished instead with serous glands, which offer little opposition to the action of chromium. Necrosis of the cartilage is not followed by regeneration, the size of the perforation being only partially reduced by cicatrization of the mucous membrane. The greater the length of time the worker is exposed to the chromium fumes, the more extensive the lesions produced. Because of the paucity of symptoms, active propaganda for individual means of defense are necessary to control this occupational disease.

The mucosa is at first hyperemic; then it becomes grayish white, and rounded spots from 1 to 2 cm. in diameter appear. These spots ulcerate and lead to destruction of the mucosa and cartilage; the perforations are round or oval, vary in diameter from 5 to 15 mm. and have clean, smooth edges. Examined histologically, the membrane shows flattening and cornification of the epithelium, the cells of which are poor in nuclei and have a tendency to exfoliate easily. The tunica propria is swollen and infiltrated with lymphatic elements, and the glands are dilated. The hypertrophy and ulceration of the mucosa represent two diverse reactions of the tissue to the intensity of the stimulus, to the various resistances of the patient and to the bacterial flora eventually present. Prophylaxis is above all based on the perfection of means to obviate the diffusion of the fumes, preferably by suction hoods over the vats, the avoidance by the workers of putting

the fingers in the nose and the use of a protective nasal ointment of petrolatum or hydrous wool fat. The use of gas masks, gloves or nasal tampons has not been found practical.

DENNIS, San Diego, Calif.

THE SONOROUS REFLEXES IN THE DOG. G. ZANZUCCHI, Arch. ital. di otol. **51**:73 (Feb.) 1939.

This article is a description of the author's technic of operating on dogs for investigation of the sonorous reflexes through opening of an osseous semicircular canal.

DENNIS, San Diego, Calif.

ROENTGEN EXAMINATION OF THE AREA OF THE LACRIMAL SAC AND THE TECHNIC OF THE ENDONASAL OPERATION ON THE SAC: REPORT OF CASES. H. BRUNNER, Klin. Monatsbl. f. Augenh. **100**:729 (May) 1938.

Brunner reports some impressions gained after performing 32 endonasal operations for removal of the lacrimal sac. The technic, described in detail, follows the routine of West and Kofler, with the exception that the medial wall of an ectatic lacrimal sac is not excised but is divided into four flaps, after the method of O. Mayer; the sac is filled with physiologic solution of sodium chloride prior to this procedure. The author considers the number of personal operations of this type too small for the conception of a definite opinion as to the value of the method. He points out in this connection that some statistics may be misleading because the outcome is not considered. Brunner adds endonasal roentgen examination to the usual parts of the examination; this permits the operator to gain a satisfactory view of the anterior portion of the nasal skeleton which cannot be obtained by the usual general exposure of the skull, and it facilitates the control of the size and changes of the operative opening in the bone. This opening begins to grow smaller, in some instances nine months after the operation. Therefore, a large osseous opening is recommended by Brunner, who agrees with Toti in this respect. A number of roentgenograms and accompanying sketches illustrate this procedure and furnish proof that small osseous openings are responsible for recurrences. The condition of the soft tissues, on the other hand, may lead to the formation of granulation tissues, even in the presence of a large osseous opening. Attention is drawn to Kofler's suggestions, which should be followed. The results of postoperative treatment seem to be improved by the local use of alcohol.

K. L. STOLL. [ARCH. OPHTH.]

INJURY TO THE INTERNAL CAROTID ARTERY IN THE SULCUS CAROTICUS. KAYSER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:377, 1938.

The author cites a case of fracture of the skull which was followed by often repeated profuse attacks of epistaxis. The causative factors were unknown, and the epistaxis still continued after ligation of the external carotid artery.

Five months after the accident, the patient succumbed after severe nosebleed. Postmortem examination showed that the internal carotid artery was torn in the region of the sulcus caroticus. The author points out the difficulty in exact diagnosis and the consequent inability to give proper treatment.

PERSKY, Philadelphia.

POLYARTHRITIS, TONSILLECTOMY AND AUTOGENOUS VACCINES. LAVAL, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:381, 1938.

The author reports the results of his treatment of a series of 20 patients suffering from polyarthritis in both the acute and the chronic form. He recommends tonsillectomy and the use of an autogenous vaccine made from the tonsils. In this small series he obtained cure in 11 cases and arrest in 2.

He believes that this form of therapy is valuable for both the acute and the early chronic form, but when permanent contractures have occurred supplemental physical therapy must be employed, and he stresses the necessity for the internist, in his treatment of rheumatic arthritis, to have the cooperation of the rhinologist.

PERSKY, Philadelphia.

A DISCUSSION OF AGRANULOCYTOSIS: HISTOLOGIC OBSERVATIONS IN THE TONSILS AND EARS AND INDICATIONS FOR TONSILLECTOMY. GRAHE, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:383, 1938.

The author reports 8 cases of agranulocytosis; in 2 the condition was apparently due to injections of arsphenamine and a bismuth preparation, and in 6 it occurred in the course of an infection, usually angina with a peritonsillar abscess; in 1 of the latter 6 it was complicated by grippal otitis media. There were 5 deaths and 3 recoveries.

Tonsillectomy was performed in 7 of the 8 cases, usually when the agranulocytosis took its origin in angina and when necrosis had not become apparent. When necrosis has become apparent, the tonsillectomy should be performed only after the blood picture has improved.

PERSKY, Philadelphia.

THE CAPACITY FOR RESORPTION AS ONE OF THE FUNCTIONS OF THE LYMPHOEPITHELIAL TISSUES. K. SAH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:426, 1938.

The author has done some experimental work in which he observed that the secretions of the mucous membranes of the sinuses can be transmitted through the lymphatic system directly to the tonsils, and in consequence that the first site of the reaction of the body to any irritant or infection by a micro-organism or a macro-organism is often the lymph nodules, the lymph sinuses or the epithelial tissue of the tonsils.

Further to substantiate this observation the author cites the case of a woman who had been taking granules of activated charcoal because of a gastric disorder for four years. In examining her because of a tonsillar infection, he found charcoal granules imbedded in the interstices of the tonsillar tissue, particularly in the lymph spaces, the lymph nodes and the loose and adventitious tissues about the blood vessels. He assumes that the granules were carried by the lymphatic channels and deposited in the tonsils. The presence of these granules in the tonsil may either act as an inflammatory agent or produce necrosis, an atrophic state or, finally, a fibrotic state. He believes that this case definitely substantiates his experimental work on both the permeability of the tonsils and their role as a reservoir.

PERSKY, Philadelphia.

Society Transactions

AMERICAN LARYNGOLOGICAL ASSOCIATION

GEORGE B. WOOD, M.D., *President*

Sixty-First Annual Congress, Rye, N. Y., May 24-25-26, 1939

CHARLES J. IMPERATORI, M.D., *Editor of Abstracts*

PRESIDENT'S ADDRESS. DR. GEORGE B. WOOD, Philadelphia.

The American Laryngological Association since its foundation in 1879 has remained not only the senior society but also the leading society in the United States for the development of laryngology and rhinology. Its fellows consist of a selected group of specialists, whose scientific and clinical work has brought American laryngology to the proud position it holds today. Not only have the fellows of the past left the abiding prestige of high endeavor, but the younger members are showing themselves capable and active, assuring the association's future success. It is recognized that high achievement has made this association an organization proud of its accomplishments, but the years of happy comradeship have developed a sympathetic friendship that has made the annual gatherings resemble a family reunion.

The essential feature of its organization is the election of a council for one year, the election being conducted in a manner which makes impossible any political activity in the selection of officers. From its foundation, this society, while believing thoroughly in the value of free discussion and debate, has been careful to avoid any radical publicity, and it recognizes the importance of preserving a high standard of professional ethics. The limited membership and the unusual care exercised in the acquisition of new fellows guarantee its future.

I urge on the fellows at this time the necessity of contributing their best work to the annual meeting. The association has a tradition of conservatism which is a firm foundation for whatever building the coming years may require, but it is hoped that the architecture of its heritage will remain worthy and beautiful, consistent with the past and present.

HISTOGENESIS OF THE TONSIL. DR. GEORGE B. WOOD, Philadelphia.

It is believed that because the anlage of the tonsil is essentially epithelial, because the lymphoid cells of the tonsil appear first after evidence of hyperplasia of the basal cells of the epithelium and because morphologic reasons for believing in the epithelial origin of these lymphocytes exist the cryptal epithelium of the tonsillar tissue must be looked on as a source of lymphoid cells. The evidence for this belief is based chiefly on the study of tonsillar development in pig embryos.

PREVENTION OF SEPTAL HEMATOMA AFTER SUBMUCOUS RESECTION. DR. WILLIAM B. CHAMBERLIN, Cleveland.

In spite of the most careful operative technic and accurate hemostasis, hematoma is likely to follow submucous resection. Most operators use clamps, petrolatum gauze packing or some form of the Bernay sponge. These are removed usually in twelve to twenty-four hours. Nevertheless, hematoma is likely to occur. It seems to be less frequent if a perforation has occurred in one of the flaps. Various types of drain, inserted diagonally from the incision toward the base of the sphenoid,

have been tried but found wanting. There seems to be no sure way of prevention of hematoma. If and when it occurs, aspiration through the incision is probably the best treatment. If it is carried out with aseptic precautions and care, abscess is not likely to follow.

DISCUSSION

Dr. Ralph A. Fenton, Portland, Ore.: I agree with the essayist on the extreme importance of preventing the onset of hematoma, because it nullifies, as all realize, the results of an otherwise excellently conceived operation. In this connection, if I might be permitted, I should like to show what has been attempted in that regard over twenty years. Instead of a drain being placed between the flaps, an incision is made high and far back on the side opposite the incision at the base, where hemorrhage is likely to occur from the region of the rostrum of the sphenoid, and the inside, between the flaps, is then painted with compound tincture of benzoin U. S. P. The inside of the flaps must be completely dry. The interior is always inspected carefully with Mosher's extensible nasal speculum. A piece of cellophane about 2 inches (5 cm.) square and greased with petrolatum is then placed on the same side as the incision. This is inserted in the nose between the wings of the ordinary nasal speculum far enough back so that packing can be readily carried out within this cellophane lining. That presses the entire septum over to the opposite side so that it is not necessary to pack the opposite side at all. Since that technic has been used, little difficulty with hematoma has been experienced. It does not seem to be necessary to pack both sides.

Dr. Henry M. Goodyear, Cincinnati: I believe that Dr. Chamberlin has brought up an important point in the treatment of hematoma of the septum. One point that I should particularly like to mention is the use of tubes after submucous resection. Ribbed tubing about ¼ inch (0.6 cm.) in diameter is suitable. Strips 2¼ or 2½ inches (5.7 or 6.4 cm.) long are cut and laid in so that they come to the end of the nose. It is only occasionally that these tubes stop up on both sides. The patient is permitted to draw back on these tubes and keep the mucus out of them during the first day, and of course they are removed with the packing at the end of the first twenty-four hours. If the tubes stop up, they may be cleaned out. I do not think that a nose should be packed so that a patient cannot breathe. If one holds one's nose closed and tries to drink a glass of water, after one has downed a single glass one will sympathize with the patient who has to try to swallow with his nose blocked for twenty-four hours.

Dr. James A. Babbitt, Philadelphia: Within the last year or two, it seems that most laryngologists in Philadelphia have accepted the plan of omitting any packing in operations on the ethmoid and sphenoid sinuses and in Caldwell-Luc operations. It was not felt until recently that this was entirely safe. I cannot help feeling that the packing of the nose, with the slough which forms and a little undue pressure that so easily comes, invites infection and complications. I have the feeling that somebody is going to find exactly the type of pressure—splint, tube, packing or something of that sort—that barely covers the hemorrhagic area.

I am quite in accord with Dr. Goodyear's plan of making a drainage. It seems to me that the ideal method would be one or two insertions of a simple through and through suture in the septum, merely to keep the flaps together. The sutures do not even need to be tied, for there will be enough pressure from packing in a rubber glove finger.

Dr. William Wesley Carter, New York (by invitation): In regard to hematoma I wish to say in the first place that I believe that hemorrhage after the submucous operation can be prevented to a large extent by the manner in which the mucous membrane is elevated from the septum. The elevator that I devised is a curet with its tip slightly out of the straight line. When its tip is

kept closely against the septum and the elevation is made gradually up and down, the vessels which are always outside the deeper layer of the mucous membrane are not injured.

Should a hematoma occur, I always regard the cavity as infected. It has been my custom to evacuate the blood clot, take a swab, dip it in pure phenol, swab out the entire cavity and then immediately apply 95 per cent alcohol. Compression is not used after this procedure.

DR. HORACE NEWHART, Minneapolis: The following suggestion came to me as a result of several hematomas which occurred within a short period. The standing orders in the hospital with which I am associated include a liquid or soft diet subsequent to the operation. The act of mastication of hard food or of gum chewing seems to be a factor in the production of hematomas.

TUMORS OF THE MAXILLAS AND THE MANDIBLE. DR. THOMAS E. CARMODY, Denver.

In connection with benign tumors, including papillomas, fibromas and lipomas, one must consider location and incidence, removal by different methods, the possibility of occurrence, the possibility of their becoming malignant and the effect on the patient's mind. A consideration of malignant growths of the mouth and adjacent structures includes the types of malignancy, the tissues involved, diagnosis by dentist or physician, the effect on the general system, metastasis, the necessity of proving metastasis before operation as influencing prognosis, the methods of removing the growth and treatment by irradiation.

DEFECTIVE SPEECH IN RELATION TO DEFECTIVE HEARING. DR. MAX A. GOLDSTEIN, St. Louis.

This article will be published in full with discussion in a later issue of the ARCHIVES.

REPORT OF A CASE. DR. CHARLES J. IMPERATORI, New York.

The patient is 18 years of age. When he was 3 years old, he came to the clinic of the Manhattan Eye, Ear and Throat Hospital suffering from papillomatosis of the larynx. At that time, radium was being used for various purposes, and radium was inserted into the child's larynx. The results were perichondritis followed by stenosis of the larynx. In the course of time tracheotomy was done

The papillomas recurred, and they were removed many times. Incident to the various removals, applications of radium and other measures, complete stenosis of the larynx developed. An internationally known laryngologist, who was visiting New York at that time, performed laryngostomy on him but unfortunately with complete failure. During my absence on a vacation, another laryngologist, in New York, did another laryngostomy on him, which also failed completely.

During the various operations, whether by the foreign laryngologist or the local laryngologist, his cricoid cartilage was partially destroyed.

I saw him again two years ago, and at that time, after speaking with Dr. Jackson about his newer method, the use of core molds, I bored a hole with a stilet through the cicatricial tissue and introduced a small core mold, no. 16. In the course of time, I was able to increase the size of the core mold to no. 28, but unfortunately I resigned from the institution at which the boy was being treated and again lost track of him. I saw him again a year ago, and I started dilation with the core molds and now have succeeded in getting the dilatation up to the point at which a no. 38 core mold is admitted.

This case is presented to bring out the following points: first, the disastrous results attending the use of radium within the larynx; second, the poor results obtained at times by laryngostomy, the underlying cause, of course, in this instance

being the destruction of the cricoid ring; third, the good results that may be obtained by the use of the core molds, as suggested by Chevalier Jackson.

This boy, incidentally, has a good pharyngeal voice.

The advice of members of the American Laryngological Association is sought regarding any further surgical procedure.

Shall the cartilaginous implantation he has on one side of his larynx be removed, or shall he have a plastic, that is, a bridge type, operation, or what shall be done?

He is wearing a tracheotomy tube, and he has a no. 38 core mold in his larynx at present.

(The patient then demonstrated his pharyngeal voice.)

DEMONSTRATION OF METHODS OF TAKING COLOR PHOTOGRAPHS OF THE LARYNX. DR. GABRIÉL TUCKER, Philadelphia.

HEADACHES FROM PATHOLOGIC CHANGES IN THE NOSE OR OTHER CAUSES: DIFFERENTIAL DIAGNOSIS. DR. T. ROY GITTINS, Sioux City, Iowa.

This article was published in full in the October issue of the ARCHIVES, page 589.

DISCUSSION

DR. EUGENE E. LEWIS, Los Angeles (by invitation): My convictions have crystallized rather definitely along the line of regarding the pains, attacks and troubles which have been mentioned in much the same light as that in which one can regard colic. I do not know why the concept of colic cannot be extended from hollow viscera to other structures, vascular structures, for instance. I am quite sure that I have witnessed in patients with such conditions a building up of a constitutional or compositional body which is characterized by certain properties dependent on the constitution at the moment. Those properties become apparent by the nature of the patient's reaction to the stimulus of the moment. The interaction between his environmental composite and his organic composite of the moment is characterized by pain or by some other response.

I am sure that if physicians can undertake to drop back into medicine far enough to forego localism for the present and study the disturbance of that set of general conditions which is manifesting the properties that are subjectively characterized by pain, local pain in the head and in the sinuses, for instance, and take steps to disturb the actual material composition to the point of unsettling the present combination of properties, they will go a long way toward avoiding misconceived local measures and approaching better conceived general measures.

DR. RALPH A. FENTON, Portland, Ore.: I must agree with many of the conclusions of Dr. Gittins' excellent presentation. I should like to ask him whether he includes in the diagnosis of migraine only those conditions arising from the various allergies or whether he includes under the head of vasomotor headaches some of those which may arise from disturbances elsewhere in the sympathetic system than in the head. I assume that he does the latter, because I think many laryngologists have noted that pains arising from the pressure of a swollen middle turbinate against a deflected septum come at the time of the climacteric and are related to the presence of fibroids or other pathologic conditions of the uterus or perhaps are related also to and coincide with the presence of mucous colitis and similar conditions.

DR. T. ROY GITTINS, Sioux City, Iowa: In answer to Dr. Fenton, I have asked many physicians to tell me what to call such headaches. I have mentioned vasomotor headaches without knowing what they are. I have never been able to find out. I mentioned vasomotor, allergic and migrainous headaches. Migraine is a disease, of course, that includes a whole group of conditions reported on in the literature with record of symptoms. Pathologic changes do not precede or follow the syndrome, and I simply do not know what to call it. In some instances it may be allergic.

A New Anatomic and Functional Systematization of the Cervical Connective Tissues: the Peripharyngeal and Postvisceral Spaces. Dr. Josef D. Weintraub, Cincinnati (by invitation).

Anatomic-Pathologic Studies of Retropharyngeal Abscess. Dr. Samuel Iglauer, Cincinnati.

These articles will be published in full with discussion in a later issue of the Archives.

Intranasal Dacryocystotomy. Dr. W. E. Sauer, St. Louis.

This article will be published in full with discussion in a later issue of the Archives.

Management of Cicatricial Stenosis of the Larynx. Dr. John H. Foster, Houston, Texas.

The object of this paper is not to offer any new methods of dealing with cicatricial stenosis. The advantages and disadvantages of the various methods advocated are considered, and an attempt is made to determine the procedure best adapted to the varied conditions met with in private practice. The saving of time by the use of thyrotomy and skin graft in certain cases is stressed. Attention is called also to the advantage of replacing and anchoring the separated ends of the cricoid cartilage.

DISCUSSION

Dr. Joseph B. Greene, Asheville, N. C.: The one type of stenosis to which the essayist did not refer is tuberculous stenosis. I have in mind conditions due to scar tissue in either the anterior or the posterior commissure. I have 3 patients in mind that have lived for a number of years. They are perfectly satisfied and comfortable after tracheotomy.

I believe Dr. Jackson agrees that dilation in such cases of stenosis is unsuitable. I have in mind a patient whom I referred to some years ago; he abstained from surgical treatment in that case. It is apt to activate the tuberculosis in such cases.

I may mention a case that Dr. Fletcher Woodward reported a few years ago, not before this association, in which he operated on a tuberculous patient successfully; but in spite of that instance of a favorable result from surgical treatment, I am still inclined to the opinion that tracheotomy offers the patient the best satisfaction and comfort.

I recall a patient living in my city at this time, a patient of Dr. Chamberlin, who was subjected to tracheotomy twenty years ago and is still comfortable with a tracheotomy tube.

Dr. Gordon B. New, Rochester, Minn.: Dr. Foster stated that the use of a skin graft is a shorter method of taking care of laryngeal strictures. It is a principle of plastic surgery that if a skin graft is used to line a cavity, pressure must be kept over the graft for a long time to prevent contraction, particularly in the correction of laryngeal strictures by excising the scar and replacing it with a skin graft. It is possible that in many cases a shorter period will suffice, but in general a rubber tube should be worn six months after skin grafting in the larynx, to keep the pressure on the graft and maintain the lumen.

Dr. Louis H. Clerf, Philadelphia: I want to compliment Dr. Foster on his emphasis on conservatism and also patience in treating laryngeal stenosis. There is one organ that will not tolerate haste, and that is the larynx. Time is an important aid here, not only as a healer but in determining whether or not the result will be good.

I was interested in Dr. Foster's reference to syphilis as a cause of the condition. It is interesting to note that the Continental literature attributes an important place to syphilis as an etiologic factor. I have never observed a case in which cicatricial stenosis of the larynx which required dilation or other forms of treatment was due to syphilis.

When thyrofissure plus dilation is needed, I am still adhering to the Schmiegelow method. I like it very much if there must be implantation of a rubber tube, and I have incorporated the skin graft method with it by putting my graft, a rather thick skin graft, around the tube, implanting the tube in the larynx and leaving it in for two or three months, according to the degree of stenosis and the amount of loss of cartilage.

Dr. Charles J. Imperatori, New York: Last year I presented, or in a discussion spoke about, several cases in which the Jackson core molds were used, and yesterday I had the opportunity of presenting a patient here that took a year to get a dilatation from a degree at which a no. 16 core mold could be admitted to that at which a no. 38 core mold would enter. This boy had been injured by the use of radium and by two Schmiegelow operations. Complete stenosis of the larynx then developed and following the Jackson technic of making an artificial opening through the stenosis and then introducing the smaller core molds, I was able to get a dilatation. I wished to present him yesterday and possibly hold a sort of postmortem discussion on the subject today because it is a question in my mind in certain cases whether any operation eventually will prove successful. It all depends on the individual case, the individual patient and the physician or the laryngologist who is taking care of him.

A year or two years is a short time. If the cricoid ring has been destroyed or injured it may be necessary to bridge it with cartilage. It has been done successfully in order to do away with the tracheotomy tube. It may be possible that for the young man who was shown here yesterday it would be the only procedure.

There are 2 other cases that I can recall at this time, both of women who sustained fractures of the larynx, the cricoid being injured in both instances.

One of the patients moved from New York to Chicago and now is under the care of Dr. Holinger. She could not tolerate the core molds. She prefers the trapdoor tracheotomy tube of Tucker and desires no further dilation.

I apologize to Dr. Law for speaking about an entirely new way of viewing the larynx which he will present tomorrow, but if he will permit me I shall say that it seems to me that with this newer method, known as tomography, for which there are few apparatus in the United States at present, laryngologists would be in a much better position to prognosticate, with the assistance of lateral roentgenograms, exactly what type of treatment will give the best results and what will happen eventually to the patient. The method consists of taking roentgenograms at various planes, anteroposteriorly. The spinal column is not seen in the ray. The ventricles, the cords, the conus elasticus and the piriform sinus are clearly shown.

Dr. Walter Kirch, Des Moines, Iowa (by invitation): A patient in whom the cricoid cartilage was injured recovered, with a hoarse voice, after replacement of the cartilage.

Dr. John H. Foster, Houston, Texas: As to Dr. Greene's reference to tuberculous patients, I have never treated stenosis in a tuberculous patient. I have always felt that it is better to leave a healed tuberculous lesion alone and let the patient breathe through a tracheotomy tube.

Dr. New spoke of the length of time that the patient must wear a tube after having a skin graft. I think that depends to a great extent on the condition. In many cases in which there are bands of scar tissue and some distortion and one can dissect the skin and tissue out fairly well without much trauma and put a skin graft in and replace the cartilage, it is not necessary for the patient to wear a tube for any length of time. In cases of that sort, I take the precaution of having the

patient come back and passing the Jackson triangular dilators through the larynx in order to see that the pathway is kept open. I rather think that if one can do that the skin graft does better. There is not any question but that strong pressure for a great length of time on the skin graft will cause it to necrose and slough out. For that reason, I have tried to get my packing out as soon as possible and change it or put a tube back. After the skin graft has been placed the O'Dwyer tube is better than a rubber tube. I believe it causes less superficial necrosis of the skin graft. It is perfectly hard and smooth.

I have tried a gold tube, but it is too heavy. I think that the pressure of the tube is a disadvantage. That is one trouble with it.

Of course, such patients have to be treated individually. A great many of them simply will not tolerate pressure. Very little pressure will cause an intense reaction. One has to take the tube out.

There is one advantage, of course, of the external operation. One allows more give to the tissues, but if an ordinary straight tube slips up a little in a child it causes an intense reaction at the base of the epiglottis and around the arytenoids.

I am firmly convinced that when the cricoid cartilage has been cut, if its ends are dissected loose and by manipulation and use of sutures buried around them brought back into position when the operation is performed the time of healing will be shorter and the result better.

LARYNGOFISSURE FOR CANCER OF THE LARYNX. DR. CHEVALIER JACKSON, Philadelphia.

It is generally admitted that failure to get good ultimate results from laryngofissure is due to operation on unsuitable patients. This raises a question of vital importance, namely, why is laryngofissure done on unsuitable patients? Some of the reasons follow:

1. Postponement of biopsy. It is amazing to note that almost all the literature treats biopsy as a last resort. It should be first and immediate in all cases in which malignant disease is a possibility.

2. Neglect of direct laryngoscopic procedure, not only to extract tissue for biopsy but as a means of examination.

3. Neglect of careful external palpation to detect evidence of internal perichondritis.

4. Dependence on exploratory operation for diagnosis.

5. The clipping technic. This should never be used except in cases in which the clip will be through healthy tissue 1 cm. wide of the growth (the 1 cm. rule). In all other cases the anterior commissure technic should be used. The greatest advance in the technic of the anterior commissure operation is the method of Chevalier L. Jackson for inspection of the interior of the larynx by means of a window opened through healthy tissue before excision.

HEADACHE. DR. HENRY A. RILEY, New York.

I shall discuss the neural components which are concerned in the appreciation of painful sensations and their transmission from the various structures of the head and the intracranial contents, the mechanism of the production of pain and the probable causes of headache.

DISCUSSION

DR. ARTHUR W. PROETZ, St. Louis: I have been exceedingly interested in the subject of pain in the sinuses for a long time and have been completely baffled. The thing that disturbs me more than anything else is the apparent lack of any association between the appearance of the membrane and the symptom of pain.

Some time ago a patient was studied whose membrane was as nearly normal as any I have ever seen and who after an exposure to an allergen to which she was susceptible suffered a swelling of the membrane in the sinus to the extent of

about a centimeter, practically obliterating the sinus. The patient was not aware of this change, and it was found only through the routine examination to which she was subjected.

It is known also that frequently a patient's nose is examined and nothing is found to account for the pain and the next day it is examined again and nothing is found to account for the pain nor is there any pain. Pain seems to have no relation to any change in color or swelling or general condition of the sinuses on which reliance can be placed.

I should like to ask whether anything is known about the end organ mechanism of pain, in the sinus, for instance, not necessarily in the head—whether it is chemical, physical or a combination of both, whether it affects the nerve or the end organ or whether anything at all is known about the mechanism of the pain-producing organism in the sinus itself.

Dr. Harris P. Mosher, Boston: In what percentage of cases has Dr. Riley found that the headaches are due to laryngologic conditions or the faults of laryngologists?

Dr. Gordon Berry, Worcester, Mass.: Does the differentiation between morning and afternoon pains and headaches have a causative factor?

Dr. Henry A. Riley, New York: I am afraid the questioners are going to draw a blank on all their questions, because I do not think I can throw any light on any of the conditions mentioned.

In regard to the direct stimulation of end organs, most end organs are so situated that they can accept some sort of physiologic stimulation. That is, they are disposed principally in surfaces or in fascial planes, or, in the case of the blood vessels, the bulbs lie in the walls of the blood vessels or occasionally annular loops pass around the blood vessels. I think it is perfectly plain how the end organs are stimulated. They are stimulated by processes or factors coming into contact with surfaces or by things producing distention of blood vessels or contraction of blood vessels.

In regard to the sinuses, the end organs are all, as I understand them, free end organs in the mucous membrane, that is, close underneath the surface of the mucous membrane and the underlying supporting tissue. Now, whether their reactions are produced by intrasinal pressure or by toxic processes or direct irritation of contained material I do not know. I imagine that both processes may be active, under varying conditions.

I do not have an explanation for the situation cited of the apparent contradiction between the appearance of the mucous membrane and the patient's description of the subjective sensation.

Other types of pain, of course, can be produced by pressure on nerve fibers, nerve trunks or nerve roots, as I said before. That I do not think enters into the situation which was spoken of, because these pains are in the periphery, in the actual lining of the sinus itself. I imagine the cause is either a mechanical or a chemical process affecting an end organ which is capable of receiving that particular type of stimulus.

In regard to the percentage of cases, unfortunately I cannot answer that at all, because all the material met with in the clinic, in the hospital or in private practice is rather well sieved out before it comes to the specialists. Therefore, all the patients that are received have gone through the diagnostic process and in that process those with nasal conditions have been eliminated, then those with sinal conditions, then those with ocular conditions and so forth, so that most of the material that my colleagues and I get is neurologic, either organic or psychogenic. The only way, I imagine, that any such figure could be reached would be simply to go through a large general clinic, taking every case in which the symptom of headache was presented, tracing the condition to its ultimate origin, and finding out how many were neurologic and how many were rhinologic.

In regard to morning and afternoon headaches, I do not know. I know that the only thing that is at all comparable is the variability in patients with cerebro-

arteriosclerosis, with whom there is a material alteration in times of the day when they feel badly and when they have their headaches. Whether that would be applicable to the question asked I do not know.

CONGENITAL TRACHEOESOPHAGEAL FISTULA WITHOUT ATRESIA OF THE ESOPHAGUS: REPORT OF A CASE WITH PLASTIC CLOSURE AND CURE. DR. CHARLES J. IMPERATORI, New York.

This article was published in full in the September issue of the ARCHIVES, page 352.

DISCUSSION

DR. LOUIS H. CLERF, Philadelphia: Dr. Imperatori has done an excellent plastic operation. I think the subject of his dissertation should be congratulated because of his survival, when one recalls the large number of physicians with whom he made contact.

My connection with the case dates back to the fall of 1936, during October, when I was consulted because of the disturbance in swallowing. The roentgen studies made by Dr. Manges exhibited definite cardiospasm, some dilatation of the esophagus and intermittent opening at the left of the diaphragm, and the diagnosis was cardiospasm. I intended to corroborate the diagnosis, but I was unable to pass a 7 mm. esophagoscope through the hiatus into the stomach, as I should have done in a 5 year old child, whether he had simple cardiospasm or not. There was definite resistance at the level of the hiatus. I subsequently attempted the procedure with a no. 5 esophagoscope, and that, too, would not pass, but a no. 4 did pass into the stomach. So that, whereas the diagnosis was cardiospasm—or call it what one will—there were undoubtedly some periesophageal changes; whether it was fibrosis I do not know, of course. There was nothing within the esophageal lumen to suggest the cause.

At about that time my connection with the case terminated, as the young man was able to swallow somewhat better. The question arising in my mind is whether the lesion is congenital. As Dr. Imperatori has indicated, the common site of fistula is at practically the bifurcation of the trachea, at times a tiny bit above and at times a tiny bit below. I never heard of a case in which the fistula was at this high level, and I am curious whether any one can give any additional light on whether the fistula actually is congenital; probably Dr. Imperatori can give some additional light, although he indicated in his title that he regards it as congenital.

DR. CHEVALIER L. JACKSON, Philadelphia: The things I should like to say are similar to those already said by Dr. Clerf.

I should like to say a word also about my endoscopic experiences in the case. Like Dr. Clerf, I first did an esophagoscopic examination, and attention was from the beginning called to the esophagus. I did not see a fistula, and my impression was that there was stenosis, so-called cardiospasm, at the lower end of the esophagus, and perhaps the reason that my associates and I did the tracheoscopy and hit on the diagnosis was that at that stage of the condition the bronchopulmonary aspect was much more in evidence than earlier. At this time a cough and the findings on physical and roentgen examination of the chest had developed as the most conspicuous symptom. Therefore, we did the tracheal examination, and the experience was worth mentioning. The endoscope, on being passed through, of course, was found to enter the esophagus almost at once. It slipped in easily. Dr. Sippel and Dr. Cunning were both present at the time, and they will recall that I thought that perhaps it had slipped off to the side of the arytenoid and into the esophagus. But in order to make sure, I withdrew it and introduced it again, exposing the larynx plainly to the view of all, and then passed it in slowly through the cords. I could definitely see the fistula. I could see the lower border of the fistula, which was constituted by the party wall between the trachea and esophagus. We felt the diagnosis was definite and then proceeded

with special roentgen studies and succeeded in visualizing the fistula in films. I advised that the fistula be closed. I felt that it was possible to close it, but I was most delighted to find that it was so successfully accomplished by Dr. Imperatori.

Dr. George B. Wood, Philadelphia: Dr. Imperatori, the child was given barium sulfate to swallow, was he not? Why did that not go through the fistula into the trachea?

Dr. Fletcher D. Woodward, Charlottesville, Va.: This is probably the first case in which a condition of this kind has ever been successfully treated.

In regard to the diagnosis, Dr. Imperatori showed a unique slide in which a bougie had been passed through the trachea into the esophagus, and having some slides here for another purpose and recalling a case in which that method was used in diagnosis, I am showing the accompanying slide. However, it happens to illustrate a case of carcinoma in which a tracheoesophageal fistula was present with the opening at the level of the bifurcation. But in order to work out the details of the condition, my associates and I passed a radiopaque ureteral bougie through the fistula and down to the esophagus, which gave considerable extra information as to the location and the nature of the fistula.

Dr. Mervin C. Myerson, New York: About twelve or thirteen years ago, Dr. Porter P. Vinson, then of the Mayo Clinic, advocated as a test for tracheoesophageal fistula the passage of a string, or the swallowing of a string, rather, and said that invariably in the presence of a tracheoesophageal fistula the string would go down to the side of the fistula on the esophageal side and wind itself around the party wall. I have seen that twice with tracheoesophageal fistula due to carcinoma.

Dr. Charles J. Imperatori, New York: Dr. Sippel has told me that the child had had three different gastrointestinal series of roentgenograms previous to the closure of the fistula.

I do not question the diagnosis of cardiospasm. The child had pylorospasm and there was no reason why he could not have had cardiospasm. The pylorospasm was operated on, and for the time being he seemed to be a little better. The manipulation of the operation did something that permitted him to swallow a little better. I feel that his symptoms of cardiospasm are very definite.

Professor Terracol, in his fine book on the esophagus, definitely pointed out in an illustration that there is such a type of fistula, and included a drawing of it.

Regarding the tracheoscopic examination done by Dr. Jackson, I feel that that was the turning point in the child's life. At a meeting of the New York Laryngological Society I was asked several questions, such as why the string appeared in this child's trachea. I felt that the reason was that the string had been regurgitated from his esophagus, that is, that because of the anchoring of it in the lower intestinal tract the loops of the string had regurgitated from his esophagus into his trachea, through his larynx. But the possibility of a fistula did not occur to me, and I did not agree with Dr. McCullagh in offering that explanation. Of course, I agree with him entirely now.

Regarding Dr. Wood's question, the child had symptoms of regurgitation from birth and many attacks of bronchopneumonia. His lung seems to be clouded, so that one might think that he had acute pneumonia. I feel that my theory of a valvelike arrangement is the explanation of his fistula and that the string going through the fistula and being pulled on both from below by the peristaltic action of the whole intestinal tract and from above by the bronchoscopic procedures or at least by Dr. Cunning, who found the string, and the looping of the string in the trachea may have in some way disturbed this sphincteric action so that it was more easily seen. But the whole area was definitely epithelized. The fistula was not an artefact. It was not a puncture wound. There was definite epithelization from the trachea into the esophagus.

I saw the fistula. I also had the good fortune to have standing by at the time of the operations Dr. Buckley and Dr. Cunning. They both saw the fistula,

and we could not see the esophagus because of this trapdoor-like arrangement on the esophageal side. I think that explains, Dr. Wood, why the barium sulfate which he had made various attempts at swallowing previously never appeared in his trachea.

I did not know of Dr. Vinson's experiment with the swallowing of string to demonstrate a fistula in the esophagus. It succeeded, of course, because the fistulas were carcinomatous and lower in the region of the jugulum. I feel that the further treatment in the present case should be hydrostatic dilation, and I hope eventually that one can speak of cure, both from the standpoint of the respiratory tract and also from the standpoint of the esophageal tract.

TONSILLECTOMY: LOCAL RESULTS AND INFLUENCE OF THE OPERATION ON SURROUNDING TISSUES. DR. EDWARD H. CAMPBELL, Philadelphia.

This article will be published in full with discussion in a later issue of the ARCHIVES.

CONSIDERATIONS OF TUBERCULOSIS OF THE LARYNX. DR. MERVIN C. MYERSON, New York.

A large series of cases of tuberculosis of the larynx has been studied. As a result statistical data have been gathered concerning various phases of the disease. If this study shows nothing else, it demonstrates the lack of value of most local therapeutic measures which have been advocated for tuberculosis.

DISCUSSION

DR. JOSEPH B. GREENE, Asheville, N. C.: I have been interested in this subject for a number of years. The chairman of this meeting started me twenty years ago in this line of work, and I still have his three types of cautery point, the puncture, the loop and what he calls the knife, the searing instrument. That shows how much I believe in the cautery.

I thoroughly agree with all that Dr. Myerson said, that certain conditions are unsuited for the cautery. I have in mind the conditions to which he refers, the acute edematous type. In reference to the use of the cautery, it seems to me that there are certain indications and contraindications, and one of the indications I have in mind is the sedimentation rate. If a patient has a poor sedimentation rate, that is, if his sedimentation is rapid, in my opinion, the condition is too acute to justify the use of the cautery in that case. However, the use of the cautery is still justified for relief of pain, but the painful conditions are usually unfavorable.

Since the use of the three types of compression therapy, pneumothorax, thoracoplasty and resection of the phrenic nerve, the incidence of tuberculosis of the larynx has diminished very much indeed.

I agree with Dr. Myerson in so many respects that I regret to disagree in one respect, that is, on the mode of infection. I can hardly think of this disease as being an infection of the blood stream and lymphatics in its origin. I shall mention several reasons. First, Dr. Myerson emphasized the fact that infection usually occurs in the posterior aspect of the larynx, and that has been my experience. That indicates that the deposit of the sputum in the posterior surface of the larynx affords a favorable site for entrance of the organism.

Then again, if it were a blood stream infection, why is it that children who have tuberculosis, who usually have no organisms in the sputum, have no infection of the larynx? They acquire meningitis, which is due to a blood stream infection, and yet they do not have any infection of the larynx.

Several reasons might be offered why I am strongly of the opinion that the disease is transmitted by contact rather than by the blood stream and the lymphatics.

Dr. Frederick T. Hill, Waterville, Maine: I, too, have been much interested in the decreasing incidence of laryngeal tuberculosis seen in the past few years with the advent of pneumothorax, phrenicectomy and thoracic surgery. Following such cases for about nineteen years in a fairly large state institution, my colleagues and I are rarely called on even to use the cautery.

Dr. Burt R. Shurly, Detroit: Throughout forty-four years, it has been my privilege to direct part of the work in several sanatoriums in Detroit. It is known that while the death rate of tuberculosis stood first on the list many years ago, it is now down to fifth place in Michigan.

In the institutions with which I am associated, my colleagues and I find from 15 to 18 per cent of patients with some involvement of the larynx. I feel that the condition is not always a blood stream infection. It seems to me that the view that it originates by contact infection is plausible and correct in many cases. Tuberculosis is now a surgical disease, a great change from the older days, when climate seemed to be the objective, with no specific and no special treatment. People have been educated now to go into a sanatorium, where all the patients with laryngeal tuberculosis belong, it seems to me, and a state law in Michigan requires that they be hospitalized.

I have never seen primary involvement of the larynx that I can remember. I should like to ask Dr. Myerson if he has seen a case of primary involvement.

The real solution of the problem is the tuberculin testing and roentgen examination of the children of the nation and the early diagnosis, when the condition is perfectly curable and when it does not involve the larynx among these children. I look to the final solution in a nationwide spread of more efficient, early diagnosis of tuberculosis, which is coming rapidly in my part of the country.

Dr. Ralph A. Fenton, Portland, Ore.: May I be permitted to make a suggestion respecting lymphatic drainage of the laryngeal region? Perhaps it is in the nature of a correction. Dr. Larsell, who was associated with me in some experimental work on the drainage of the sinuses some years ago, brought out that the drainage from the larynx is downward and lateral, into the laryngeal glands and then on down toward the mediastinum, but that the material drained from these glands falls directly into the pulmonary circulation, drops in on both sides and is pumped directly out to the periphery of each lung.

Now it is understandable that in the course of laryngeal tuberculosis, as I think those with experience will agree, occasionally the patients seem to decline with extreme rapidity with an acute miliary spread. It is understandable that the infection may go in through the thoracic duct and thus into the circulation from drainage of the laryngeal glands, but that is downward instead of upward. I should be inclined to agree with Dr. Shurly and others that the liability of implantation by direct contact is more probable.

Dr. Gordon B. New, Rochester, Minn.: I should like to ask Dr. Myerson whether in the group, of 8 patients, I think, that died without having organisms in their sputum the diagnosis was questionable. I take it a check was made post mortem to show tuberculosis. In a group seen at the Mayo Clinic the question of blastomycosis and torulosis came up when the condition was clinically tuberculosis but the sputum did not contain the organisms. I am wondering whether in the huge group of 2,000 cases the question of blastomycosis and torulosis was considered.

Dr. Fletcher D. Woodward, Charlottesville, Va.: A survey of patients admitted to one of the state hospitals during five years, from 1923 to 1928, against a similar group admitted from 1933 to 1938, showing the results of modern treatment, is of interest. My associates and I feel that the addition of collapse therapy has been the one thing which has done the most to lower the incidence of laryngeal tuberculosis, because the organisms disappear from the sputum earlier. Therefore, that is the answer to the complication of laryngeal tuberculosis. The sooner the

organisms can be eliminated from the sputum, the less chance there is of the development of laryngeal tuberculosis.

In the first group, of 1,090 patients, admitted during five years 12.5 per cent had tuberculosis of the larynx on admission; in a similar group, of 1,139 patients, admitted during the past five years 13.3 per cent had tuberculosis of the larynx on admission. That looks as if perhaps the incidence is not lower, but I think that it is, because many patients are now admitted to the sanatorium that in the first five years would have been sent home to die. We treated only early tuberculosis years ago, whereas now we take any patient that presents himself at the sanatorium. So the percentage of laryngeal tuberculosis there is about the same as it was ten years ago.

Of these patients, 95.6 per cent in the first group and 90.1 per cent in the second group had tubercle bacilli in the sputum on residence in the sanatorium. On dismissal from the sanatorium, 63.2 per cent of the first group still had the organisms in the sputum, whereas in the second group the incidence was diminished to 50.2 per cent. So that we have 13.2 per cent in our favor, which I believe, considering that the more severe, more advanced conditions are treated, is largely because collapse therapy has been added to our treatment.

Of the 136 patients with laryngeal tuberculosis in the first group, 14 per cent received cauterization of the larynx; of the 152 in the second group, 19 per cent, approximately the same. But in the first group only 4.4 per cent, 6 patients, received collapse therapy with artificial pneumothorax only, whereas in the second group, 49.3 per cent, 75 patients, received collapse therapy of various types. At discharge from the sanatorium, 44.1 per cent in the first group were improved, whereas 52.6 per cent in the second group were classified as improved and this group, of course, as I said before, included patients with much more severe tuberculosis than were present in the first group.

We feel that collapse therapy is an important factor in the cure and prevention of laryngeal tuberculosis.

Dr. George B. Wood, Philadelphia: Perhaps I am somewhat like Dr. Greene. I cannot quite agree with everything that Dr. Myerson has said. In the first place, I am convinced that the method of infection is never lymphatic, that the primary infection is never brought to the larynx from lymphatics that are outside of it but that it may be brought by the blood stream. Just how often that occurs, I am not certain. It apparently occurs in some cases exactly as does tuberculosis of the hip. To my mind, that is the exception, and the large majority of infections are from contact with sputum that comes from the lungs.

In the first place, in practically every case laryngeal tuberculosis has been preceded by pulmonary tuberculosis. In the second place, the lesions are superficial in their early stage and immediately beneath the epithelium and not in the deep layers of the mucosa.

The occasional development of laryngeal tuberculosis with a negative reaction of the sputum does not preclude the possibility that the larynxes may have been infected by sputum that some time earlier in the patient's life contained tubercle bacilli. According to Manasses, the infection may gain access to the subepithelial layer either as a result of minute trauma or, as Lake has pointed out, through minute intraepithelial pyogenic abscesses that are frequently seen in chronically affected larynxes; on the other hand, they have been demonstrated passing through normal epithelium. They have certainly passed through the normal epithelium of the intestinal tract and through that of the tonsil.

I am absolutely convinced that no local therapy is of any value in the treatment of laryngeal tuberculosis as compared with the application of the actual cautery. The only patients for whom I refuse to use it are those with a hopeless condition in whom the least trauma, the least excitement or the least discomfort adds to the general pain and unhappiness. I have never encountered a case of tuberculosis, either acute or chronic, in which I thought the cautery was contraindicated, except by the general debility of the patient.

DR. MERVIN C. MYERSON, New York: I was very much aware when I said that the larynx was invaded by way of the blood stream that I should stir up some real discussion. Perhaps more has been learned because of that discussion. I appreciate the assistance that I have received from the various discussers in making this presentation more valuable. I agree with Dr. Greene about the use of the cautery for painful conditions, and I think that it should not be withheld for any type of ulceration but should be used for searing the surfaces of the ulceration, because frequently one reaches the sensory nerve endings and relieves the patient, at least temporarily, of his pain.

There are undoubtedly some cases in which the condition is due to contact, but there are many cases in which one cannot disregard the hematogenous method of spread to the larynx. The pediatricians and pulmonary specialists state that children have an entirely different type of tuberculosis from adults. In them the lymph nodes are infected. When this lymphatic type reaches a terminal stage, it is not unusual for a child's larynx to become involved by way of the blood stream. Fortunately, because they have this type rather than a true pulmonary type, involvement of the larynx is not seen as it is in adults.

I should like to call attention also to the fact that almost 60 to 70 per cent of the lesions which have been observed on the tongue are located in areas of the tongue which would not ordinarily make contact with the sputum. In other words, they are not on the dorsum but on the under surface in the region of the frenum and anterior to it.

I should go further than Dr. Wood and claim that the sputums not containing tubercle bacilli are evidence of a hematogenous condition, and in addition to claiming this I call attention to the fact that it is not at all uncommon to see patients with no organisms in the sputum who have the laryngeal condition.

Now as to primary involvement, I think primary involvement can be dismissed with this one statement, that up to the present time (perhaps tomography will change the concept) diagnostic procedures have not been adequate to enable one to say positively that a patient does or does not have tuberculosis of the lung when he has a lesion of his larynx. In other words, he may have a lesion in his lung which is not shown on the ordinary roentgenogram.

The concept of the spread of tuberculosis from a pulmonary lesion is that it goes by way of the lymphatics into the blood stream: Occasionally it passes from a local focus directly into a capillary or blood vessel, but usually it goes into the major lymphatics, and then into the thoracic duct and then spills into the blood stream.

I do not know anything about the 8 patients who died without tubercle bacilli in their sputum. I do know that between 80 and 90 per cent of the patients who die are submitted to autopsy and there were none among this group with blastomycosis or torulosis.

I agree with Dr. Woodward about the value of collapse therapy, but one must not make any blanket statements as to its value in all cases. In other words, patients are encountered who have had the benefit of collapse therapy and who do not improve. They frequently have a tracheal or bronchial lesion.

In answer to Dr. Wood, I am well acquainted with Manasses' work, but I should like to call attention to the fact, first, that anybody who has tried to examine the lymphatic vessels histologically will state that it is almost impossible to outline them by any method, and, second, that I reviewed over 900 slides in this study and I took many of them in the beginning of the study. I thought that I saw the thrombolymphangitis which Manasses described, and I tried to get three or four pathologists to corroborate my finding, and they would not. They said that they never find thrombolymphangitis anywhere in other organs, that they have not seen it in the larynx and that they could not find it in my slides. My associates and I did special stains on about 30 slides, and we could not depend on our findings there. So I do not know whether Manasses' findings are correct. They may be all right, and we may not know how to look at the lymphatics.

PLASTIC REPAIR OF THE FRONTAL BONE. DR. GORDON B. NEW, Rochester, Minn.

Acquired defects of the frontal bone are usually secondary to radical operations on the sinuses, intracranial operations, automobile accidents and cured malignant disease. They require correction for cosmetic reasons and to alleviate the symptoms complained of by patients with absence of the full thickness of the skull. Costal cartilage has been found to be the material of choice for correction of bony defects of the frontal bone. Five cases are reported. A colored motion picture will be shown.

DISCUSSION

DR. SAMUEL SALINGER, Chicago: I am exceedingly interested because of several experiences that I have had along similar lines. Two or 3 minor posttraumatic depressions that I have encountered were easily corrected. One patient, both of whose frontal sinuses had been completely obliterated, caused considerable difficulty. This patient had also had an abscess of the frontal lobe which necessitated two or three operations. He eventually recovered but had a hideous deformity which extended over the entire supraorbital region from one external angular process to the other.

One large rib graft was placed within the depression, and quite by accident, I believe, I left a little of the perichondrium on, which gave it the necessary contour, that is, the necessary convexity. I should like to ask Dr. New whether he makes it a point to strip the perichondrium entirely or whether he ever uses the perichondrium for the purpose of obtaining a convexity.

DR. THOMAS E. CARMODY, Denver: I should like to emphasize what Dr. New says, that nothing should be done for the traumatic conditions for a little time. When bone and cartilage are used I find the contour remains rather good, but if the cartilage is used alone, frequently it is absorbed. I should like to ask Dr. New about that. As a rule, I strip the periosteum off, but there is a possibility that in some cases it should be left.

DR. HARRIS P. MOSHER, Boston: My associates and I have been responsible, in part, for creating more hideous deformities of the forehead than any shown by Dr. New. In other words, in dealing with fulminating osteomyelitis of the frontal bone as we see it, we have settled down to rather a routine operation, which calls for the removal of the whole of the frontal bone. That leaves a marked deformity.

We have found in dealing with cartilage the same trouble that Dr. Carmody spoke of, that it is absorbed. Dr. Kazanjian, in dealing with these deformities, makes a two stage operation, the first step being to get the skin flaps together. We use a median incision, so that we can see all around and work easily through the off corners of the frontal bone. The first job is to get the flaps together, after waiting at least three months. Then comes the attempt at repair of the deformity. Dr. Kazanjian has settled down to using a tibial graft. The graft when one sees it first is a bit surprising. I do not believe that it would surprise Dr. New by the extensiveness of the procedure, but it astonished my associates and me at first. He takes a graft according to the defect, from the tibia, makes it pliable by saw cuts, puts it in, takes another one if there is anything left of the shin, puts that above the first one, then gets his measure of correction and after that fills in with cartilage. That is the procedure which is being used now, and it is fairly satisfactory.

I do not believe that any of the extensive deformities will ever be perfectly removed. I was interested in the use of the pattern; that also is a great help.

DR. MERVIN C. MYERSON, New York: I should like to ask Dr. New to what extent the defect is overcome by the production of osteoid tissue. I am not speaking of the tremendous defects, but I am thinking of the patients who have had resection of the frontal sinus and some of the adjacent bone because of osteomyelitis that is complicating disease of the frontal sinus. I might say that at the hospital with which I am associated the neurosurgeons have been collecting sections of the skull, and my colleagues and I thought that we could use them as

replacements for defects, but it seems to me that they are more or less valueless, because they invariably become infected and we have to remove them.

Dr. Charles J. Imperatori, New York: Dr. New has presented excellent photographs with wonderful depth of focus.

There is a guest here today, Dr. Carter, who is one of the pioneers in the work of transplanting cartilage.

Dr. William Wesley Carter, New York (by invitation): Dr. New's exhibition of his work is the best I have ever seen.

I have had some experience in transplanting bone and cartilage, and a number of years ago I began to use conjoined bone and cartilage in the correction of nasal deformities, to which my experience has been largely confined. I have corrected a few cranial defects, but that has been a minor portion of my work. Two of the corrections of cranial defects with which I felt more gratified than with any others were accomplished by the use of tiny splints of bone. They were removed from the rib and were largely composed of the cancellous tissue near the junction of the cartilage and bone. I found after six or eight months that a considerable osteogenesis had occurred and that the defects, which were small in the cases in which I operated, had become osseous, and this led me to believe that in many cases an osseous deformity can be corrected by the use of finely chipped pieces of bone containing considerable cancellous tissue which is rich in osteoblasts.

The use of cartilage is preferable in many cases to the use of bone, because it is far more easily handled. I have used portions of the seventh, eighth and ninth ribs.

In reference to the preservation of the perichondrium, I will say that I never preserve it, because I have found that when I did so in my corrections of nasal deformities, toward the tip, where I wished to preserve flexibility, the perichondrium had a tendency to curl the cartilage up.

I have not had any trouble from the absorption of cartilage unless there is an accidental infection at the time of the operation. If there is, the cartilage is absorbed, and in many instances the bone has to be removed. But in a number of instances I have been able by antiseptic methods to control the infection, and the portion of the bone that remained had a dendritic look, as if the portions that had died from the infection had been absorbed and the rest of the transplant had remained.

Dr. E. Ross Faulkner, New York: I wish to ask Dr. New a question: How much regeneration of bone occurs after osteomyelitis?

An infant, 9 months of age, was operated on for osteomyelitis of the frontal bone, and the whole bone was removed. After three years, complete regeneration has taken place.

I wonder if Dr. New has had an experience like that. I think the child would have been better if it had not made such complete regeneration of the bone.

In regard to reconstruction after operation on the frontal sinus, I think I have a few derelicts I shall send to Dr. New. I have always regarded the staphylococci as sleeping dogs. It is just as well to let them lie in a great many cases. I always feel a little apprehensive about operating in such cases until a long period after the original infection.

I think there is no question that the rib cartilage is by far the best material to use for overcoming the defects, but I hesitate to operate until I am pretty sure that the infection has ceased.

Dr. Gordon B. New, Rochester, Minn.: On the question of preserving the perichondrium, it has been brought out by some of the discussion that in getting certain contours, building an island and procedures of that kind, if one saves the perichondrium one will get a curve. For that reason my associates and I take it off in most of our cases in which we use cartilage.

On the question of absorption of the cartilage, in the cases I have presented, four years, two years and one year have elapsed since I put the cartilage in, and

I have not seen any absorption. It has been my experience in general that it has not been absorbed.

Of course, I am well acquainted with Dr. Kazanjian's work, to which Dr. Mosher referred. I talked with him about the method of handling the cases. He does the work, of course, as Dr. Mosher has brought out. He uses the periosteum graft, building it up in stages and then using the cartilage to finish and to fill in the defects. I should think that in cases such as Dr. Mosher has outlined this method is certainly the treatment of choice.

In infants, such as Dr. Faulkner referred to, there is a great deal of regeneration, while in adults I have not seen that occur.

I was delighted to have Dr. Carter discuss this work, because I remember visiting him twenty years ago and seeing the wonderful work he did.

FURTHER EXPERIMENTS IN THE ACTION OF DRUGS ON THE NASAL MUCOSA. DR. ARTHUR PROETZ, St. Louis.

This article was published in full in the October issue of the ARCHIVES, page 509.

DISCUSSION

DR. THOMAS E. CARMODY, Denver: I should like to ask Dr. Proetz if when ether or chloroform is dropped on the membrane it will be restored after a little or the disintegration is so great that there will be an ulceration.

DR. THOMAS C. GALLOWAY, Evanston, Ill.: I should like to ask Dr. Proetz if he has done any work on carbon dioxide in relation to his study of anesthetics. Waters has recently reported work which indicates that carbon dioxide might be irritating to the mucosa of the respiratory tract.

DR. ARTHUR PROETZ, St. Louis: I have had no experience, Dr. Galloway, with carbon dioxide. While the experiment with nitrogen monoxide was going on my associates and I frequently found that we had to warm the gas as it came through, because the chilling of the gas in the valve of the tank made the air so cold that it stopped the cilia. As soon as that was dispensed with, the cilia were not affected.

As for the destruction when the anesthetic touched the membrane, the disability lasted as long as we could keep up an experiment with one animal in the course of several hours in the day. From the appearance of the membrane and from the general disintegration, I think that a resuscitation of the surface would be impossible. I should think that the process would have to be one of regeneration.

SINUSITIS: THE PRESENT RATIONALE OF TREATMENT. DR. CHARLES T. PORTER, Boston.

In the treatment of acute sinal disease, rhinologists are in danger of becoming too stereotyped. Some writers say that one should never operate, while others are inclined always to advise operative treatment. The best results are obtained by evaluating each case and using the procedure which seems best under the existing circumstances. Cases of chronic sinusitis can be divided into three main groups. Conservative treatment is applicable to certain types of subacute condition. Allergic conditions require careful investigation in order to determine the most effective treatment. Chemotherapy has become more valuable against all acute conditions. The antagonistic attitude of the general practitioner and the public to any operative procedure for sinal disease is becoming a serious problem to the rhinologist.

DISCUSSION

DR. RALPH A. FENTON, Portland, Ore.: The tendency to abandon overtreatment, such as the use of strong antiseptic drops, is largely due to the work which has been done by Dr. Proetz and Dr. Lierle. But still rhinologists often ignore allergy, as allergists often ignore the work which rhinologists are doing.

One must agree that operation, if it is done at all, must be complete, whether it is for the ordinary condition or for the condition with an allergic complication.

That principle, I think, should be basic. I feel that in practice in the West in general the rule is to avoid operation in the acute stage of severe and fulminating infections. At the present time reliance has come to be placed on the use of sulfanilamide rather early.

With local drainage and the infraction of a middle turbinate perhaps, it has been found that sulfanilamide kept at a constant concentration by daily and nightly use and given not in excessive doses but rather in steady, moderate doses, according to the principles brought out in the excellent studies of Osgood, works out best. But in any case in which sulfanilamide is used check must be made by daily leukocyte and erythrocyte counts, because one will find undesirable complications from that if one does not observe closely the reaction of the individual patient.

Respecting diathermy, it may be recalled that Dr. Larsell and I checked up on the tissues of a number of patients whom we caused to be treated by diathermy in the presence of chronic sinal disease in the antrums, and all that we found it did was to attract red blood cells and cause a highly hemorrhagic membrane, which was much harder to operate on when we brought the patients to operation.

However, a few persons, having had the use of diathermy, refused operation because they felt better. Perhaps that was psychologic. I do not know.

Respecting the matter of roentgen treatment, that originated with Drs. Butler and Woolley in Portland, Ore., who are excellent roentgenologists, but became obsessed with the notion that small doses of carefully filtered roentgen rays are highly beneficial for all types of sinal disease.

Dr. Woolley cooperated with Dr. Larsell and me by asking us to study the results of experimental irradiation of a number of cats in which we had produced artificial sinusitis, according to the method which we laid down in our research some years ago. After the sinusitis had been in existence from a week to six weeks or two months, irradiation was done; then we recovered the membranes. The conclusion was that all that the roentgenization does is to kill round cells. Apparently the release of the alexins, the immune bodies contained in these cells, was responsible for the good condition in which certain of the membranes were found; there was no effect on the influx of white cells, and there was no effect on the destruction of pus. It was not destroyed, and that was brought out by certain prominent radiologists who joined in the discussion at Cleveland. So this treatment is apparently dangerous and is likely to be taken up by quacks, as I pointed out in my discussion five years ago at Cleveland.

Dr. Samuel McCullagh, New York: Dr. Wood, I should like to ask Dr. Coates and his confrères from Philadelphia, who have been using camirol, to make a little further report on the use of that drug or combination of drugs in the treatment of sinal disease. I have used it myself since they recommended it to me, with beneficial results.

Dr. William Wesley Carter, New York (by invitation): I should like to ask Dr. Porter if he has found that bronchiectasis is frequently associated with chronic sinusitis, if he has ever used sulfanilamide in the treatment of it and what his results are. I realize that this question is not quite germane to the subject, but it is an important corollary.

Dr. George M. Coates, Philadelphia: I am in accord with most of the things which Dr. Porter has said, although not quite with all of them.

I was particularly interested in his reference to roentgen irradiation, because a wave is sweeping over the country of having sinusitis treated by roentgen rays, largely promoted by the roentgenologists themselves.

I know that the best roentgenologists in Philadelphia think that roentgen irradiation of sinal infections is effective, and they base the opinion not only on Dr. Woolley's work but on their personal experiences. I can think probably of three or four leading roentgenologists in Philadelphia who assert that they have cured themselves after having run the gamut of regular rhinologic treatment, including operation, which of course makes them, feeling as they do, think that this is an effective method of treatment. When, however, I have referred my

patients to these same roentgenologists, the results have not been satisfactory to me or to my patients as a rule. I do not know whether the treatment has any beneficial effect but I do not think that it should have, certainly not for chronic conditions.

I disagree with Dr. Porter a little about the efficacy and the danger of needle puncturing the antrum for washing out chronically infected maxillary sinuses. I think all will agree, of course, that the introduction of the needle into a sinus filled with hyperplastic tissue is not only dangerous but absolutely without benefit. When hyperplastic membrane is not present or not very much hyperplastic membrane is present and the sinus has a definitely purulent secretion, I am quite convinced the old plan of washing out, for a trial period, at any rate, often does quiet the infection and give the mucous membrane of the antrum a chance to recover a little, so that even if a radical operation is necessary later, the mucous membrane is in better condition for it.

An obliterative operation on the sinus, of course, aside from the deformity it causes, is the ideal termination of chronic sinal infection. It is not feasible for infection of the maxillary, ethmoid or sphenoid sinuses.

I cannot agree with Dr. Porter in his statement that it is most useful in the case of large frontal sinuses. It seems to me that the obliterative operation is particularly applicable when the frontal sinus is relatively small and particularly when it is shallow, when the sinking in of soft tissue gives rapid obliteration.

I agree entirely with him that if an obliterative operation is attempted it must be absolutely complete, that the least shred of mucous membrane, which is always infected, of course, that is left will surely lead to failure of that type of operation.

I observe a good many cases of osteomyelitis, but I have not personally seen osteomyelitis develop after a radical operation on the frontal sinus except in 1 instance in which the Lynch operation was done, the floor of the frontal sinus being removed for the purpose of avoiding the possibility of osteomyelitis.

I entirely agree with Dr. Porter that when the anterior plate of the frontal sinus is necrosed it is a temptation to take that away and let the rest of it go. I think it can be done if the necrosis is limited to the frontal plate. When it extends to the junction of the internal plate and the external plate I always fear the development of osteomyelitis. When it is found at operation that this has already occurred, I think it is wise to go ahead and be radical and remove the bone with a considerable margin, as advocated by Dr. Mosher.

I dislike to talk about camirol, because, after all, it is a proprietary preparation. It is a combination, in a vegetable oil base, of camphor, iodoform and other forms of iodides, all of which have been recommended at various times in the books on pharmacology. I think that its use is of value as an adjunct treatment, that it does not replace, in most instances, the ordinary methods of treatment of either acute or chronic sinal infection and that it is of value especially for acute conditions and acute flare-ups, such as Dr. McCullagh has experienced.

Dr. Frederick M. Law, New York: I do not know whether I am here to defend the rhinologist or the roentgenologist. Personally, I am not in favor of roentgen treatment of the sinuses. The treatment started in this way: In the old days, when plates were used, exposure was necessarily long, and every roentgenologist observed the fact that many times a patient with an acute condition of the frontal sinus had pain relieved after an interval of about a half-hour—relieved temporarily, it is true, but relieved.

Personally, I do not undertake therapy; therefore, what I have to say is only on observation and hearsay. I suppose I have not any right really to criticize. Now, roentgenologists display films showing involvement of the antrum before and after treatment. Perhaps, as often happens, the first films were made by one roentgenologist, the second films by another. I will show at the end of my paper two films made of the same patient at the same time, one showing a diseased antrum and one a normal antrum.

So, the chances are that a great many of the reports of clearing of the antrum are due to the technic in the making of the film. I have talked with many roentgenologists. The majority are not in favor of this treatment; the minority are.

Dr. William B. Chamberlin, Cleveland: I am not sure that I am quoting Dr. Porter correctly. I understood him to say that with acute conditions puncture of the antrum is dangerous and that with subacute and chronic conditions it is unnecessary. Is that correct, Dr. Porter?

Dr. Charles T. Porter, Boston: Not exactly. I said that with acute conditions it is dangerous and that it is efficacious for subacute but not for chronic conditions.

Dr. William B. Chamberlin, Cleveland: First of all, in regard to acute conditions, I have heard, of course, the dictum of Furstenberg and Lillie, pupils of Canfield. Now I do not know personally from my own experience how these conditions can be treated by the methods that Canfield and his pupils advocate. It seems to me that with an acute condition of the antrum, for instance, needle puncture is going to relieve the patient. In the thousands of cases that I have observed, not only in my clinic but in the experience of my confrères, I have yet to observe the first case of osteomyelitis from antral puncture. I should like to get the expression of the other members of the association.

Osteomyelitis from operations on the frontal sinus and external operations on the ethmoid sinuses is something entirely different.

I appreciate very much what Dr. Porter said about the relation between the rhinologist and the allergist. Many patients are treated by allergists alone. Personally, from my own experience, and that of my confrères, I have about lost faith in allergy.

Dr. Burt R. Shurly, Detroit: The members of the association are certainly indebted to Dr. Porter for bringing up a subject that is an everyday one for the rhinologists and that is met with daily in the office and in the hospital.

I feel that the problem of sinal disease can never be anything but a problem of the individual patient. I believe that when the patient comes into the office seeking comfort and relief, one's duty is to give him all of that in continuous attention to the various phenomena that one has to deal with in that particular person.

Now major operations, it is well known, are essential and absolutely necessary, but it is a comparatively small number of patients with diseased sinuses that require a major operation. There are 90 or 95 per cent of other sufferers who come to the rhinologist. And is it forgotten that the patient has a definite immunity of his own? He is confronted with a special virulence of the infection which is attacking him at a particular time, and he is also an individual, temperamental or otherwise. I have taken care of a number of members of the theatrical profession, who are entities. With such a person the nervous system is entirely an emotional discharge, and a sinal infection to him means a loss of his job, or it means a serious matter.

Then, again, there are persons who are entirely influenced nowadays by their next door neighbors or the bridge partners they had in the afternoon and whose treatment of the condition is just like their friends'.

I find sulfanilamide of tremendous importance, and I think it should be used more and more but its use should be carefully guarded. One should ascertain that the patient does not have Bright's disease or a serious dyscrasia of the blood and check one's use of it accordingly.

Then, again, I believe with Dr. Chamberlin there are acute infections with which the sinuses can be washed out with great relief and that a general rule cannot be made for all cases and all people.

Dr. James A. Babbitt, Philadelphia: I have felt many times that a careful and complete irradiation of the sinuses acts therapeutically.

In selected cases, camirol has helped some of my patients.

DR. CHARLES T. PORTER, Boston: First, I shall briefly try to answer Dr. Fenton on the use of sulfanilamide. I tried to convey that I do not use it for early or for uncomplicated conditions. For conditions that show an immediate complication, like cellulitis, my associates and I institute its use at once if we have the proper culture. But for uncomplicated sinal disease, I do not believe it is necessary, and Dr. Lyons, whose work I follow, maintains that it is much better to let the patient develop his own antibodies, if he will.

Dr. McCullagh has been answered about camirol, and I know nothing about it.

Dr. Carter, my associates and I do not have patients with bronchiectasis ourselves in our wards. They are in the thoracic or the pulmonary clinic of the Massachusetts General Hospital. I believe that the physicians in those clinics have had indifferent success in some of the cases in which they have tried sulfanilamide. That could be understood from our bacteriologic findings, and in bronchoscopic examination of the patients we frequently find a variety of secondary invaders, and we are finding a few molds which seem to be secondary but not as innocuous as one often thinks they are.

I thank Dr. Coates for his agreement and his difference. As to antrum puncture, if I had been going to enlarge on that I should have said that I never puncture an antrum and would not advise one being punctured without, first, a good roentgenogram, particularly with an acute condition, in which the mucous membrane is swollen. The puncture goes through this, and the fluid may be forced into the swollen lining instead of the cavity of the antrum. If one wishes to include the subacute stage as the next stage beyond that, when the membrane has shrunk and there is a large cavity filled with pus, then one may puncture it, if one likes, or wash it out from the normal osteum, or one can shrink the nose and use suction; any of the three methods frequently gives good results.

As regards the obliterating operation on large sinuses that are pocketed off, my associates and I think that there is no danger of recurrence, osteomyelitic changes or secondary infection, although I still believe that osteomyelitis is a quality inherent in the infecting organism.

DR. GEORGE B. WOOD, Philadelphia: The puncture into the maxillary sinus is sure to bring more or less trauma into a mucosa that readily will pick up the infection. I have seen severe hemorrhages following antral puncture. I mention that as one of the dangers of puncturing with acute maxillary sinusitis. I never do it.

PRESENTATION OF A COLORED MOTION PICTURE OF THE LARYNX MADE BY THE INDIRECT METHOD OF LIGHTING. DR. GABRIEL TUCKER, Philadelphia.

REVIEWING ROENTGENOGRAPHY OF THE SINUSES AND LARYNX. DR. FREDERICK M. LAW, New York.

The roentgen examination of the accessory sinuses and the larynx has shown comparatively little advance in recent years. The only outstanding possibility is the development of the tomograph, by which structures at predetermined depths may be fairly well shown without the superimposition of extraneous shadows.

The most important advance is the increasing ability of surgeons to interpret their own films properly. They should now learn to appreciate the sources of possible erroneous interpretation due to technic and to anatomic departure from the average. These changes are discussed. The more capable the rhinolaryngologist is in criticizing the films, the better will be the work of the roentgenologist.

DISCUSSION

DR. GORDON B. NEW, Rochester, Minn.: I should like to ask Dr. Law one question, whether with this new method he has been able to determine involvement of cartilage in malignant disease. With the difference in ossification of the thyroid cartilage, with this method can one tell when carcinoma has involved or perforated through the cartilage?

DR. FREDERICK M. LAW, New York: In reply to the first question, I should say, "Yes." Regarding the second question, I should definitely say, "With limitations."

DR. THOMAS C. GALLOWAY, Evanston, Ill.: How long does the process take, and what is the dose of irradiation to the tissue?

DR. FREDERICK M. LAW, New York: Chiefly in use is a meter calibrated for 65 kilovolts with 60 milliamperes. Exposure is for one second with the tube at a distance of 30 inches (76 cm.), so the dose is considerable. If one has to cut many sections, especially in the chest, one has to be careful. Four sections of the larynx are quite sufficient, and that is perfectly safe. There is another way of making a tomograph by using pulley wheels instead of a lever, but it is not as efficient.

DR. CHARLES J. IMPERATORI, New York: I think the members of the association are greatly indebted to Dr. Law for his exposition of the new methods of roentgen diagnosis. I wish to speak particularly about this method, tomography, that was shown by Dr. Leborne in New York just recently. I am rather of the opinion that it is possible that laryngologists will change their ideas regarding the classification of growths in the larynx because of this method of viewing them roentgenologically; particularly views regarding prognosis will be changed, for the degree of infiltration can be seen; even though one is an endoscopist and may use a direct laryngoscope and see beneath the vocal cord and determine the possibility of subglottic infiltration, still with this method one gets a view of the piriform sinus, which frequently one never sees by either direct or indirect laryngoscopic examination. I think it is definitely an advance in diagnostic methods.

DR. RALPH A. FENTON, Portland, Ore.: May I ask a question of Dr. Law, whether the method described is superior to that advocated by a European roentgenologist who inserts a covered film in the hypopharynx, behind the larynx? Has Dr. Law had experience with that method?

DR. FREDERICK M. LAW, New York: I have had no experience with it, but I can see the disadvantage. I can see this advantage of the tomograph over that method. It shows the entire larynx; the other shows merely a portion.

DR. GORDON B. NEW, Rochester, Minn.: My associates and I have used both methods, and tomography has given us more information.

DR. FREDERICK M. LAW, New York: The difference in the level of the infiltrated area depends on the technic. The section must be cut absolutely parallel with the long axis of the larynx. Therefore, a change in that axis is going to change the depth of the infiltrated area, but if the section is wrong, the area will always appear shorter than it really is because of the tilting.

Directory of Otolaryngologic Societies *

FOREIGN

Collegium Oto-Rhino-Laryngologicum Amicitiæ Sacrum

President: Dr. Louis Ledoux, Brussels, Belgium.
Secretary: Prof. Dr. C. E. Benjamins, Verlengde Heereweg 143, Groningen, Netherlands.

Hungarian Otolaryngological Society

President: Dr. V. Zimányi, Zárda-u. 48, Budapest II.
Secretary: Dr. G. Kelemen, Reáltanoda-u. Budapest IV.

Sociedad Rioplatense de Oto-Rhino-Laringología (Argentine Section)

President: Dr. Raul Becco, B. Mitre 1690, Buenos Aires.
Secretary: Dr. Juan Manuel Tato, Santa Fé 1171, Buenos Aires.

Société Française d'Oto-Rhino-Laryngologie

Secretary: Dr. Henri Flurin, 19 Avenue Mac-Mahon, Paris, 17e.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. A. W. Proetz, 3720 Washington Blvd., St. Louis.
Secretary: Dr. Leroy A. Schall, 270 Commonwealth Ave., Boston.
Place: New York. Time: June 10-14, 1940.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Frank Brawley, 30 N. Michigan Ave., Chicago.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.

American Bronchoscopic Society

President: Dr. Lyman Richards, 319 Longwood Ave., Boston.
Secretary: Dr. Paul H. Holinger, 1150 N. State St., Chicago.

American Laryngological Association

President: Dr. James A. Babbitt, 1912 Spruce St., Philadelphia.
Secretary: Dr. Charles J. Imperatori, 108 E. 38th St., New York.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

President: Dr. Lee M. Hurd, 39 E. 50th St., New York.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.
Place: New York. Time: June 6-8, 1940.

SECTIONS:

Eastern.—Chairman: Dr. John R. Simpson, Medical Arts Bldg., Pittsburgh.
Place: Pittsburgh. Time: Jan. 5, 1940.
Southern.—Chairman: Dr. Walter J. Bristow, Doctors Bldg., Columbia, S. C.
Place: Columbia, S. C.. Time: Jan. 8-9, 1940.
Middle.—Chairman: Dr. Sam E. Roberts, Professional Bldg., Kansas City, Mo.
Place: Kansas City, Mo. Time: Jan. 19, 1940.
Western.—Chairman: Dr. Pierre Viole, 1930 Wilshire Blvd., Los Angeles.
Place: Los Angeles. Time: Jan. 26-27, 1940.

AMERICAN OTOLOGICAL SOCIETY

President: Dr. Horace Newhart, 527 Medical Arts Bldg., Minneapolis.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.